THE

POCKET GRAY;

OR,

Anatomist's Vade-Mecum.

COMPILED ESPECIALLY FOR STUDENTS.

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PREFACE.

THIS little book is intended as a pocket remembrancer of Anatomy, and contains only the bare facts of that science. As such it is hoped it will prove useful to students.

In its compilation the author has made frequent references to the leading text-books; especially to the works of Gray, Ellis, Quain, Heath, and Leonard, in order that it might be as reliable as possible.

Especial prominence has been given to those subjects which are most likely to be forgotten by students, whilst Osteology has been omitted altogether; it being a subject too large to be treated with justice in so limited a space.

September, 1879.

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THE POCKET GRAY;

OR,

ANATOMISTS' VADE-MECUM.

THE LIGAMENTS.

ARTICULATIONS OF THE TRUNK.

I.—ARTICULATIONS OF THE VERTEBRAL COLUMN.

The Ligaments of the Bodies.

The anterior common ligament: a broad band of fibres, extending along front of bodies of vertebræ, from axis to sacrum, the fibres being attached principally to the intervertebral substances.

The posterior common ligament extends along back of bodies of the vertebræ from axis to sacrum, being broad opposite the intervertebral discs, and narrow opposite the bodies.

The intervertebral substances, found between each movable vertebra, thickest in lumbar region; they give the peculiar curves to the column by their differences in thickness.

The Ligaments of the Laminæ.

The ligamenta subflava connect the laminæ of the movable vertebræ, attached to the posterior surface of an arch below, and to the anterior surface of an arch above.

The Ligaments of the Articular Processes.

Capsular ligaments surround the articular processes, those in the cervical region being the loosest.

The Ligaments of the Spinous Processes.

The interspinous ligaments extend between the spinous processes of the vertebræ, running from root to summit.

The supraspinous ligament: a fibrous cord, joining the tips of the vertebræ, and extending from the seventh cervical to the first sacral.

The Ligaments of the Transverse Processes.

Intertransverse ligaments extend between the transverse processes, often absent in the cervical, thin in the lumbar, but round and well marked in the dorsal region.

II.—LIGAMENTS OF THE ATLAS AND AXIS.

The anterior atlo-axoid ligament consists of a superficial and a deep part. The *superficial* part continues the anterior common ligament. It is attached above to the anterior tubercle of the atlas; and below to the body of the axis and base of the odontoid process. The *deep* part is broad, and reaches from the lower border of the anterior arch of atlas to the base of odontoid process and body of axis.

The posterior atlo-axoid ligament, a thin layer connected above to the lower border of the posterior arch of atlas, and below to the upper edge of laminæ of axis.

The transverse ligament keeps the odontoid process in its place; it is attached on each side to a tubercle on the inner surface of the articular process of the atlas.

Capsular ligaments as in ordinary vertebræ.

III.—LIGAMENTS OF THE ATLAS AND OCCIPUT.

The anterior occipito-atloid ligament is comprised of a superficial and a deep part. The *superficial* rounded is attached to the basilar process of the occiput above; and to the anterior tubercle of the atlas below. The *deep* part broad is attached, above, to the anterior edge of the foramen magnum, and below, to the upper margin of anterior arch of atlas.

The posterior occipito-atloid ligament, thin and membranous, is attached, above, to posterior margin of foramen magnum; below, to upper border of posterior arch of atlas,

(Perforated on each side by vertebral artery and suboccipital nerves.)

The lateral occipito-atloid ligaments. One on each side, attached above to the jugular process of occiput, and below to the base of atloid transverse process. **Capsular**, as in ordinary vertebræ.

IV.—LIGAMENTS OF THE AXIS AND OCCIPITAL BONE.

The occipito-axoid ligament (*apparatus ligamentosus colli*) : a continuation of the posterior common ligament, connected above with basilar groove of occiput, and below to posterior surface of body of axis.

The odontoid or check ligaments consist of two cords passing from the apex of the odontoid process to the sides of the foramen magnum, close to the condyles. In the interval between the two the *ligamentum suspensorium dentis* passes from the apex of the odontoid process to the anterior margin of the foramen magnum.

V.—TEMPORO-MAXILLARY ARTICULATION.

The external lateral ligament, attached above to tubercle and outer surface of zygoma, below to outer and posterior edge of neck of lower jaw.

The internal lateral ligament, attached above to the spinous process of the sphenoid, below to the inner margin of the dental foramen.

The stylo-maxillary ligament: a thin cord extending from the styloid process to the angle of jaw.

(*Stylo-hyoid ligament:* a fibrous cord, extending from the styloid process to small cornu of hyoid bone.)

The capsular ligament : thin and loose, attached above to edge of glenoid cavity and articular eminence, below to the neck of the condyle.

The interarticular fibro-cartilage has an oval shape, the upper surface is concavo-convex from before backwards, and slightly convex transversely; the lower surface is just the reverse.

Synovial membranes, two in number, one above and one below the fibro-cartilage.

VI.—ARTICULATION OF THE RIBS WITH THE VERTEBRÆ.

Articulations between the Heads of the Ribs and the Bodies of the Vertebræ.

The anterior costo-vertebral or stellate ligament is composed of three fasciculi, which radiate from the anterior surface of the head of the rib. The *superior* fasciculus passes to the vertebra above. The *inferior* fasciculus to the vertebra below. The *middle* fasciculus to the intervertebral substance.

A capsular ligament surrounds articulation between the head of the rib and articular surface formed by two vertebræ.

The interarticular ligament divides the joint into two parts, each of which has a separate *synovial membrane ;* it passes between ridge on head of rib and intervertebral substance. (Absent in the 1st, 10th, 11th, and 12th ribs.)

Articulation of the Necks and Tubercles of the Ribs with the Transverse processes.

The anterior costo-transverse ligament, attached below to upper border of neck of ribs, above to lower border of transverse process. (Absent in 1st and 12th ribs.)

The middle costo-transverse or interosseous ligament: a short thick band passing from transverse process to posterior surface of neck of rib.

The posterior costo-transverse ligament passes from apex of transverse process to rough non-articular part of tubercle of rib. (Absent in 11th and 12th ribs.)

The capsular ligament surrounds articular surfaces, enclosing a small synovial membrane. (This articulation is absent in the 11th and 12th ribs.)

VII.—ARTICULATION OF THE CARTILAGES OF THE TRUE RIBS WITH THE STERNUM.

The anterior costo-sternal ligament : a broad thin band radiating from extremity of cartilage of rib to the sternum.

The *superior* fasciculi pass obliquely upwards; the *inferior* downwards, and the middle horizontally.

The posterior costo-sternal ligament is an indistinct band of fibres radiating from the posterior surface of the inner end of the costal cartilage to the back of the sternum.

The capsular ligament surrounds the joint and encloses a synovial membrane. (In the 1st there is no synovial membrane, in the 2nd there are two.)

Articulations of the Cartilage of the ribs with each other.

The cartilages of the 6th, 7th, and 8th ribs articulate with each other by an oval-shaped facet, each having a capsule enclosing a synovial membrane.

Articulations of the Ribs with their Cartilages.

The costal end of each cartilage fits into a depression in the sternal end of the rib, and is bound down by periosteum.

VIII.—LIGAMENTS OF THE STERNUM.

The 1st and 2nd pieces are united by a piece of cartilage, kept together by the following two ligaments:

The anterior sternal ligament consists of longitudinal fibres, which blend with the costo-sternal ligaments.

The posterior sternal ligament: similar to the preceding, placed on the back of the sternum.

IX.—ARTICULATION OF THE PELVIS WITH THE SPINE.

The following ligaments connect the 5th lumbar vertebra with the sacrum, and are similar to the common vertebral ones.

1. The continuations of the **anterior and posterior common ligaments.**
2. **The intervertebral substance.**
3. **The ligamenta subflava** between the laminæ of the last lumbar vertebra and the sacral canal.
4. **Capsular ligaments**, between the articulating processes.
5. **Interspinous and supraspinous ligaments.**

Besides these there are the following:

The lumbo-sacral ligament: attached above to the ransverse process of the 5th lumbar vertebra, below to the uter border of the lateral mass of the sacrum.

The ilio-lumbar ligament passes from the tip of transverse process of 5th lumbar vertebra to the crest of ilium in ront of sacro-iliac articulation.

X.—ARTICULATIONS OF THE PELVIS.

Articulations of the Sacrum and Ilium.

The sacro-iliac articulation is formed between the lateral surfaces of the sacrum and ilium. The auricular or anterior parts of the articular surfaces are covered with cartilage and connected by the two following ligaments:

The anterior sacro-iliac ligament: small band passing horizontally from sacrum to ilium.

The posterior sacro-iliac ligament consists of strong interosseous bands connecting the rough part of the ilium behind the cartilage with the posterior part of the sacrum. The superficial part is sometimes called the *oblique sacro-iliac* ligament, and reaches from the posterior superior iliac spine to the 3rd lateral sacral tubercle.

Ligaments between the Sacrum and Ischium.

The great (*or posterior*) **sacro-sciatic ligament**, attached by its base to the posterior inferior iliac spine, to the 4th and 5th lateral sacral tubercles, and to the lower part of the edge of the sacrum and coccyx; passes downwards, outwards, and forwards, to be attached to the inner edge of the ischial tuberosity and the inner margin of the ramus forming the *falciform* ligament.

The small (*or anterior*) **sacro-sciatic ligament** passes from the spine of the ischium to the lateral margin of the coccyx and sacrum.

Articulation of the Sacrum and Coccyx.

The anterior sacro-coccygeal ligament, very indistinct, passes from anterior surface of sacrum to that of the coccyx.

The posterior sacro-coccygeal ligament passes from the margin of the lower orifice of the sacral canal to the posterior surface of the coccyx.

A fibro-cartilage is placed between the sacrum and the coccyx.

Articulation of the Pubes.

The anterior pubic ligament consists of several layers of fibres crossing the symphysis horizontally.

The posterior pubic ligament resembles the anterior, but is much less distinct.

The superior pubic ligament connects the bones superiorly.

The sub-pubic ligament forms the upper boundary of the pubic arch, and is a thick triangular arch of fibres, attached above to the fibro-cartilage and laterally to the rami.

The fibro-cartilage consists of two parts, one on each bone; the two are united in front, but posteriorly they are separated by a small cavity, lined by a synovial membrane.

ARTICULATIONS OF THE UPPER EXTREMITY.

I.—STERNO-CLAVICULAR ARTICULATION.

The anterior sterno-clavicular ligament is attached to upper and anterior part of the inner end of the clavicle, and to the upper and anterior part of the 1st piece of the sternum.

The posterior sterno-clavicular ligament passes between the inner end of the clavicle and the sternum on the posterior surface.

The interclavicular ligament passes along the top of the sternum from the inner end of one clavicle to the other.

The costo-clavicular or rhomboid ligament: a strong band of fibres passing from the upper surface of 1st costal cartilage to a rough marking on the under surface of the inner end of the clavicle.

The interarticular fibro-cartilage is a nearly circula plate. It is attached above to the upper border of the cla vicle, and below to the 1st costal cartilage at its junction with the sternum. There are two *synovial membranes.*

II.—SCAPULO-CLAVICULAR ARTICULATION.

The superior acromio-clavicular ligament passes between the outer end of the clavicle and the acromion on the upper surface.

The inferior acromio-clavicular ligament covers the joint below, and is attached to the clavicle internally and the acromion externally.

The coraco-clavicular ligaments connect the clavicle and the coracoid process of the scapula ; they are :—

The trapezoid ligament (the *anterior* and *external* one) : attached below to the posterior half of the inner border of the coracoid process, and above to the oblique line on the under surface of the clavicle.

The conoid ligament (the *posterior* and *internal* one) is attached above by its base to the conoid tubercle on the inferior surface of the scapula and the contiguous part, by its apex to a rough depression at the base of the coracoid process.

The interarticular fibro-cartilage is very frequently absent, or only occupies the upper half of the joint. When it is present there are two *synovial membranes*, but when it is absent there is only one.

III.—PROPER SCAPULAR LIGAMENTS.

The coraco-acromial ligament passes over the shoulder joint between the coracoid and acromion processes. Externally it is attached to the tip of the acromion, and internally to all the outer border of the coracoid process.

The transverse or posterior ligament stretches over the notch on the upper border of the scapula, and converts it into a foramen.

IV.—THE SHOULDER JOINT.

This joint between the head of the humerus and the glenoid cavity is an enarthrodial or ball and socket joint. The long tendon of the biceps acts as a ligament to this joint.

The capsular ligament is attached to the circumference of the glenoid cavity, and to the neck (anatomical) of the humerus. It is very loose, and permits free movement of the joint. There is generally an aperture on the inner side, where a piece of the synovial pouch is protruded to form the bursa under the subscapularis.

The coraco-humeral, or **accessory ligament**, helps to strengthen the capsule ; it is attached to the outer border of the coracoid process, and below it blends with the capsule at the margins of the bicipital groove.

The glenoid ligament is a fibro-cartilaginous band attached to the edge of the glenoid cavity to deepen it, and is continuous with tendon of the long head of the biceps.

A synovial membrane lines the joint, and protrudes to form the bursa under the subscapularis.

V.—THE ELBOW JOINT.

The elbow is a ginglymus or hinge joint, and is formed between the trochlear surface of the humerus and the sigmoid cavity of the ulna ; the upper end of the radius also assists.

The anterior ligament is attached above to the front of the humerus above the coronoid fossa, and below to the coronoid process and the orbicular ligament.

The posterior ligament is attached above to the upper border of the olecranon fossa, and below to the olecranon.

The internal lateral ligament is triangular in shape ; it is attached above to the inner condyle of the humerus ; the fibres diverge as they descend, the *anterior* ones going to the inner margin of the coronoid process, the *posterior* to the inner margin of the olecranon.

The external lateral ligament, smaller than the preceding, is attached above to the external condyle, and below to the orbicular ligament.

The synovial membrane is very large, covering the articular surfaces of the humerus and ulna, it also serves for the upper radio-ulnar articulation.

VI.—THE RADIO-ULNAR ARTICULATIONS.

Superior Radio-ulnar Articulation (lateral ginglymus).

The orbicular ligament surrounds the head of the radius. It is attached to the two ends of the lesser sigmoid cavity, and is wider above than below. The *outer* surface is connected with the external lateral ligament. The internal surface is lined with synovial membrane continuous with that of the elbow joint.

Middle Radio-ulnar Articulation.

The oblique or **round ligament** is a fibrous cord passing downwards and outwards from the tubercle at the base of the coronoid process to the radius, a little below the tubercle.

The interosseous membrane passes downwards and inwards (the opposite to the preceding) from the radius to the ulna; it is attached to the interosseous ridge of each bone.

Inferior Radio-ulnar Articulation (lateral ginglymus).

The anterior radio-ulnar ligament passes from the anterior edge of the radial sigmoid cavity to the anterior surface of the head of ulna.

The posterior radio-ulnar ligament extends similarly upon the posterior surface.

The triangular fibro-cartilage passes transversely beneath the lower end of the ulna, between the styloid process and the radius. Its apex is attached to the base of the styloid process, and the base to the edge of the radius, between the sigmoid cavity and lower end.

The synovial membrane (*membrana sacciformis*) is very loose, and lines the contiguous surfaces of the radius and ulna, together with the upper surface of the triangular cartilage.

VII.—THE WRIST JOINT (ARTHRODIAL).

The external lateral ligament passes from the tip of the styloid process of the radius to the outer surface of the scaphoid bone.

The internal lateral ligament, a fibrous cord, passes from the end of the styloid process of the ulna, and divides into two, one part being attached to the pisiform bone and the other to the inner side of the cuneiform bone.

The anterior ligament, broad and membranous, consists of three bundles of fibres, springing from the anterior edge of the lower end of radius, the styloid process (radial) and the ulna; below it is fixed into the anterior surfaces of the scaphoid, semilunar, and cuneiform bones.

The posterior ligament, weaker than the preceding, springs from the posterior margin of the lower end of the radius, and is attached to the dorsal surfaces of the scaphoid, semilunar, and cuneiform bones.

A synovial membrane lines the joint.

VIII.—ARTICULATIONS OF THE CARPUS.

Articulations of the 1st Row of Carpal Bones (arthrodial).

The dorsal ligaments pass transversely between the scaphoid and semilunar, the semilunar and the cuneiform.

The palmar ligaments connect the bones similarly upon the anterior surface.

The interosseous ligaments (2) close the upper part of the intervals between the scaphoid, semilunar, and cuneiform bones.

Articulations of the 2nd Row of Carpal Bones (arthrodial).

The dorsal ligaments (3) pass transversely from bone to bone as in the 1st row.

The palmar ligaments (3), similar to those of the 1st row.

The interosseous ligaments (2) are thicker than those of the 1st row, and connect the os magnum and the trapezoid, the os magnum and the unciform bones.

Articulations of the two Rows of Carpal Bones together.

The anterior or **palmar ligaments** pass from one row to another on the palmar surface.

The posterior or dorsal ligaments are similarly placed upon the dorsal surface.

The lateral ligaments: the *external* connects the scaphoid and trapezium bones, the *internal* the cuneiform and unciform.

The synovial membrane is large: it lines the under surface of the bones of the 1st row, except the pisiform bone, and is reflected between their contiguous surfaces; it then passes between the bones of the 2nd row, and lines their contiguous surfaces, giving also reflections between the carpal ends of the four inner metacarpal bones.

IX.—CARPO-METACARPAL ARTICULATION.

The Articulation of the Trapezium and 1st Metacarpal.

A very free arthrodial joint.

The capsular ligament, thick and loose, passes from the upper end of the 1st metacarpal to the rough edge round the articular surface of the trapezium. It is lined by a separate synovial membrane.

Articulations of the Carpus and Metacarpus.

The dorsal ligaments connect the carpal with the metacarpal bones on the posterior surface; each metacarpal receives two fasciculi, except the 5th, which has only one.

The palmar ligaments are similarly arranged on the anterior surface, except that the 3rd metacarpal has three fasciculi.

The interosseous ligaments connect the os magnum and unciform bones to the 3rd and 4th metacarpal bones.

The synovial membrane has been described above.

Articulations of the Metacarpal bones with each other.

The carpal ends are united by **dorsal and palmar ligaments** passing transversely.

The interosseous ligaments pass between the bones beneath the level of the articular facets. The *synovial membrane* has been described above.

The digital extremities are connected by the transverse ligament, and blend with each metacarpo-phalangeal articulation.

X.—METACARPO-PHALANGEAL ARTICULATIONS.

The anterior ligament, fixed to the head of the metacarpal bone and the base of the 1st phalanx, intimately blend with the transverse ligament.

The lateral ligaments, one on each side, attached above to the tubercle on the side of the head of the metacarpus, and below to the side of the 1st phalanx.

XI.—ARTICULATIONS OF THE PHALANGES.

These are small ginglymus or hinge joints, connected by an *anterior* and *two lateral* ligaments.

ARTICULATIONS OF THE LOWER LIMB.

I.—THE HIP JOINT.

This is an enarthrodial joint, formed by the head of the femur and the acetabulum. The ligaments are:

The capsular ligament, very strong and fibrous, surrounds the acetabulum above, springing just external to the cotyloid ligament; where the bone is deficient it is attached to the transverse ligament: below it is attached to the neck of the femur, in front to the anterior intertrochanteric line, superiorly to the root of the neck, and posteriorly to the middle of the neck of the bone. There is often an opening in front for a protrusion of the synovial membrane to form the bursa, under the psoas.

The ilio-femoral ligament (*Y ligament of Bigelow*) is accessory to the capsule. It is connected above with the anterior inferior iliac spine, and below it bifurcates and is attached to the anterior intertrochanteric line.

The ligamentum teres passes from the depression on the head of the femur and divides into two parts, which are attached to the margins of the notch at the bottom of the acetabulum. It checks rotation outwards, and adduction when the limb is flexed.

The cotyloid ligament is attached to the edge of the acetabulum, prismatic on section, the base being attached to the hip bone.

The transverse ligament is a narrow band which crosses the notch at the lower part of the acetabulum ; under it the nutrient vessels to the joint enter.

The synovial membrane is single, and is reflected over the inner surface of the capsules on to the neck of the femur, thence over the ligamentum teres to the bottom of the acetabulum, at the bottom of which it covers loosely some fat, and is darker in colour.

II.—THE KNEE JOINT.

This is a ginglymus, and is formed by the condyles of the femur, the head of the tibia, and the patella.

Exterior Ligaments.

The anterior or **ligamentum patellæ** is the contination of the tendon of the triceps extensor. Above it occupies the apex and rough marking on the posterior surface of the patella, and below it is attached to the lower part of the tubercle of the tibia.

The posterior ligament (*ligamentum posticum Winslowii*), broad and thin, covers the back of the joint. It consists of a central and two lateral parts. The lateral parts spring above from the condyles of the femur, and are attached below to the head of the tibia. The central part is derived from an expansion of the semi-membranosus tendon, and passes from the inner tuberosity of the tibia to the outer condyle of the femur.

The internal lateral ligament, broad and flat, attached above to the inner condyle of the femur, below to the inner tuberosity and inner surface of the shaft of the tibia for 1½ inches.

The long external lateral ligament, a rounded cord, is attached above to the external condyle of the femur, and below to the external part of the head of the fibula.

The short external lateral ligament, very indistinct, lies parallel and behind the preceding, attached above to the outer condyle of the femur, and below to the **styloid process** of the fibula.

The capsular ligament, thin, fills up the intervals between the special ligaments; it is attached to the margins of the articular surfaces of the bones.

Internal Ligaments.

The anterior crucial ligament is attached to the depression in front of the spine of the tibia and to the external semilunar fibro-cartilage, passes upwards, backwards, and outwards to the inner and posterior part of the external condyle of the femur.

The posterior crucial ligament is attached to a depression behind the spine of the tibia, to the popliteal notch, and the external semilunar fibro-cartilage; it passes upwards, forwards, and inwards to the anterior part of the outer surface of the inner condyle.

The semilunar cartilages are thicker at the outer than the inner margins, and serve to deepen the cavities for the head of the femur.

The internal semilunar cartilage is oval in shape, the antero-posterior diameter being the longer. Its anterior extremity is attached to the tibia *in front* of the anterior crucial ligament, and the posterior extremity *in front* of the posterior crucial ligament.

The external semilunar cartilage is nearly circular: its anterior extremity is attached to the tibia in front of the spine, the posterior extremity to the back of the spine.

In shape the cartilages may be described thus: the internal as a smaller segment of a larger circle, and the external as a larger segment of a smaller circle.

The Attachments to the Head of the Tibia from before backwards are: 1. Transverse ligament. 2. Anterior extremity of internal semilunar cartilage. 3. Anterior crucial ligament. 4. Anterior extremity of external semilunar cartilage. 5. Posterior extremity of external semilunar cartilage. 6. Posterior extremity of internal semilunar cartilage. 7. Posterior crucial ligament.

The transverse ligament is a band of fibres which passes between the anterior extremities of the semilunar cartilages.

The coronary ligaments bind down the circumferences of the semilunar cartilages to the head of the tibia.

The synovial membrane is the largest in the body. It extends two inches above the articular end of femur under the extensors; thence it passes over the crucial ligaments to the head of the tibia, where it covers both sides of the semilunar cartilages, and lastly it lines the capsule. It also gives a covering to the popliteus tendon, where it is in the joint.

The ligamentum mucosum is a triangular fold of the synovial membrane, attached to the intercondyloid notch, and reaching to the patella.

The ligamenta alaria are two fringes of the synovial membrane, seen on either side of the ligamentum mucosum.

III.—THE TIBIO-FIBULAR ARTICULATIONS.

The Superior Tibio-fibular Articulations (arthrodial).

The anterior superior ligament passes from the head of the fibula upwards and inwards to the external tuberosity of the tibia.

The posterior superior ligament passes from the back part of the head of the fibula to the back part of the external tuberosity of the tibia.

A synovial membrane lines the joint.

The Middle Tibio-fibular Articulation consists of the interosseous membrane, the fibres passing down from the tibia to the fibula, and is attached to the interosseous ridges on the bones.

The Inferior Tibio-fibular Articulation.

The inferior interosseous ligament passes between the contiguous rough surfaces of the tibia and fibula, and is continuous above with the interosseous membrane.

The anterior inferior ligament is triangular in shape, and passes between the adjacent margins of the tibia and fibula.

The posterior inferior ligament is similarly placed upon the posterior part of the articulation.

The transverse ligament passes transversely across the back of the joint from the external malleolus to nearly the internal malleolus.

The synovial membrane is continuous with that of the ankle joint.

IV.—THE ANKLE JOINT.

This is a ginglymus or hinge joint.

The anterior ligament, broad and thin, is connected above with the edge of the articular surface of the tibia, and below with the margin of the superior articular surface of the astragalus.

The internal lateral or **deltoid ligament** consists of two parts. The *superficial* part is attached by its apex to the internal malleolus, and by its base to posterior part of the astragalus, the sustentaculi tali and the tuberosity of the scaphoid. The *deep* part passes from the apex of the malleolus to the side of the astragalus.

The external lateral ligament consists of three bundles of fibres. The *anterior* slip passes between the front of the external malleolus and the side of the astragalus in front of the superior articular process. The *middle* passes from the apex of the outer malleolus to the middle of the outer side of the os calcis. The *posterior* passes from a deep groove behind the articular surface of the outer malleolus to the posterior surface of the astragalus.

The synovial membrane lines the inner surface of the ligaments, and is reflected on to the articular surfaces of the bones.

V.—ARTICULATIONS OF THE TARSUS.

Articulations of the 1st Row of Tarsal Bones.

There are two articulations between the calcaneum and the astragalus; they are arthrodial joints.

The external calcaneo-astragaloid ligament passes from outer surface of the astragalus to the outer edge of the os calcis.

The posterior calcaneo-astragaloid ligament connects the posterior parts of the two bones.

The interosseous ligament consists of a strong thick band passing from the groove between the articulating surface of the astragalus and a corresponding groove on the os calcis.

There are two **synovial membranes**, one for each joint.

Articulations of the 2nd Row of Tarsal Bones.

The articulations between the scaphoid, cuboid, and three cuneiform bones are connected by the following :

Dorsal ligaments, which pass from one bone to the other.

Plantar ligaments, similarly arranged upon the sole.

Interosseous ligaments (4) strong fibres passing between the rough non-articulating surfaces of the bones.

Articulations of the two Rows of the Tarsus with each other.

The ligaments of the joint between the os calcis and the cuboid :—

The superior calcaneo-cuboid ligament passes between the dorsal surfaces of the os calcis and cuboid bones.

The internal calcaneo-cuboid ligament, attached to a deep groove on the os calcis between it and the astragalus, and passing to the inner side of the cuboid bone.

The long calcaneo-cuboid ligament (*ligamentum longum plantæ*), attached to the under surface of the os calcis in front of the tuberosities ; it passes to the posterior margin of the peroneal groove of the cuboid, some of the fibres arch over the sheath of the tendon, and are attached to the bases of the 2nd, 3rd, and 4th metatarsal bones.

The short calcaneo-cuboid ligament is more deeply placed, and lies to the inner side of the preceding ; it reaches from the tubercle on the under surface of the os calcis to the under surface of the cuboid behind the peroneal groove.

The ligaments between the os calcis and scaphoid are :

The superior calcaneo-scaphoid arises from the groove between the astragalus and os calcis, and is attached to the outer side of the scaphoid bone.

The inferior calcaneo-scaphoid is attached to the front of the sustentaculi tali, and passes to the hollow on the under surface of the scaphoid bone.

The articulation between the astragalus and scaphoid is an arthrodial joint. The only ligament is the

Superior astragalo-scaphoid, passing from the neck of the astragalus to the upper surface of the scaphoid bones.

The tarsal synovial membranes are four :

One for the posterior calcaneo-astragaloid articulation.

One for the anterior calcaneo-astragaloid articulation.

One for the calcaneo-cuboid articulation.

One for the articulations of the scaphoid, and the three cuneiform bones ; the cuneiform bones with each other ; the external cuneiform and the cuboid ; and the middle and external cuneiform bones with the bases of the 2nd and 3rd metatarsal bones.

VI.—TARSO-METATARSAL ARTICULATIONS.

The metatarsal bones are connected to the tarsus by

Dorsal ligaments, one to each metatarsal bone from the tarsal bone it articulates with. The 2nd metatarsal has a slip from each cuneiform bone.

The plantar ligaments, disposed irregularly.

The interosseous ligaments, strong bands, three in number. The *internal* one passes from internal cuneiform to the 2nd metatarsal. The *middle* one passes between the external cuneiform and the 2nd metatarsal. The *external* connects the external cuneiform and the 3rd metatarsal.

The synovial membranes (3) : one between 1st metatarsal and internal cuneiform; one for 2nd and 3rd metatarsals, with middle and external cuneiform, same as 4th tarsal membrane ; and one for 4th and 5th metatarsal with cuboid.

VII.—ARTICULATIONS OF THE METATARSAL BONES WITH EACH OTHER.

The bases of the metatarsal bones are connected by *dorsal*, *plantar*, and *interosseous* ligaments.

The digital ends are united by the *transverse metatarsal ligament*, which connects the 1st metatarsal with the others.

VIII.—METATARSO-PHALANGEAL ARTICULATIONS.

These articulations are precisely similar to the corresponding parts of the hand.

IX.—ARTICULATIONS OF THE PHALANGES.

The preceding remark equally applies to these articulations.

THE MUSCLES.

Explanation.

The — dash divides the origin from the insertion.
Nervous supply is indicated by ( ) brackets.
F signifies that the attachment is fleshy.
T ,, ,, tendinous.
A ,, ,, aponeurotic.
A combination of any of these may occur.

MUSCLES OF THE HEAD AND NECK.

EPICRANIAL REGION.

Occipito frontalis: *Frontal part.* Os nasi and internal angular process of frontal bone, blended with obicularis palpebrarum, pyramidalis nasi and corrugator supercilii(F)—

epicranial aponeurosis(A) (Facial, Super-trochlear, Supra-orbital). *Occipital part.* Outer ⅔ superior curved occipital lines, mastoid processes(T)—epicranial aponeurosis, which is attached behind to curved line between fleshy heads(A) (posterior auricular).

AURICULAR REGION.

Attrahens aurem ; fore part of epicranial aponeurosis(F) —fore part of helix(T) (Auriculo-temporal of small occipital).

Attollens aurem : epicranial aponeurosis(F)—cranial surface of pinna(T) (Small occipital).

Retrahens aurem : root of mastoid process(F)—lower cranial surface of concha(A) (Posterior auricular).

PALPEBRAL REGION.

Orbicularis palpebrarum : *Orbital part.* Internal angular process of frontal, tendo palpebrarum, nasal process of superior maxilla(F), *sphincter of eyelids. Palpebral part.* Tendo palpebrarum(F)—external tarsal ligament(F) (Facial, Supra-orbital).

Corrugator supercilii : inner part of superciliary ridge of frontal(F)—under surface of orbicularis, opposite middle of orbital arch(F) (Facial, Supra-orbital).

Tensor tarsi : ridge of os lachrymalis(F)—orbicularis by side of tarsal cartilage(F) (Facial).

ORBITAL REGION.

Levator palpebræ superioris : inferior surface of small wing of sphenoid, anterior to foramen opticum(T)—anterior part of superior tarsal cartilage(F) (3rd).

Rectus superior : upper margin of optic foramen(T)—sclerotica(T) (3rd).

Rectus inferior : optic foramen(T)—sclerotica(T) (3rd).

Rectus internus : optic foramen(T)—sclerotica(T) (3rd).

Rectus externus : *Upper head.* Optic foramen(T). *Lower head.* Optic foramen and process of bone at sphenoidal fissure(T)—sclerotica(T) (6th). *Between the two heads pass 3rd, 6th, nasal branch of 5th nerves and ophthalmic vein.*

Obliquus superior: inner part of optic foramen(T)—passes through "pulley," thence attached to a right angle to sclerotica (T) (4th).

Obliquus inferior: depression on orbital plate of superior maxilla(F)—external surface of sclerotica(T) (3rd).

NASAL REGION.

Pyramidalis nasi: occipito-frontalis(F) — compressor nares(A) (Facial).

Compressor naris: canine fossa of superior maxilla(F)—its fellow of opposite side(A) (Facial).

Levator labii superioris alæque nasi: top of nasal process of superior maxilla(F)—cartilage of ala, orbicularis oris(F) (Facial).

Depressor alæ nasi: incisor fossa of superior maxilla(F)—septum and ala of nose(F) (Facial).

Dilatator naris: *Anterior slip.* Cartilage of ala(F)—inner border of integuments of ala(F). *Posterior slip.* Nasal notch of superior maxilla(F)—inner border of integuments of ala(F) (Facial). *Only visible with a lens.*

SUPERIOR MAXILLARY REGION.

Levator labii superioris: superior maxilla and malar, above infra-orbital foramen(F)—orbicularis oris(F) (Facial).

Levator anguli oris: canine fossa of superior maxilla, beneath infra-orbital foramen(F)—angle of mouth(F) (Facial).

Zygomaticus major: malar bone in front of zygoma(F)—angle of mouth(F) (Facial).

Zygomaticus minor: malar bone near maxillary suture(F)—angle of mouth(F) (Facial).

INFERIOR MAXILLARY REGION.

Levator labii inferioris, *vel.* **levator menti**: incisor fossa of inferior maxilla(F)—integument of chin(F) (Facial).

Depressor labii inferioris, *vel.* **quadratus menti** : oblique line of inferior maxilla from symphysis to mental foramen(F)—orbicularis oris(F) (Facial).

Depressor anguli oris, *vel.* **triangularis menti** : oblique line of inferior maxilla(F)—angle of mouth(F) (Facial).

INTER-MAXILLARY REGION.

Orbicularis oris, *sphincter of mouth:* the external part to subjacent bone. In the upper lip to septum nasi; in the lower lip to canine fossa of inferior maxilla(F) (Facial).

Buccinator : external surfaces of alveolar processes of superior and inferior maxillæ, as far as 1st molar; pterygo-maxillary ligament(F)—angle of mouth where fibres decussate(F) (Facial, Inferior maxillary).

Risorius : fascia covering masseter(F)—apex of depressor anguli oris(F) (Facial). (*This muscle is part of the platysma of neck.*)

TEMPORO-MAXILLARY REGION.

Masseter : lower border and inner surface of zygomatic arch(F)—outer surface of coronoid process, ramus and angle of inferior maxilla(F) (Inferior maxillary).

Temporal : temporal fascia and fossa(F)—internal surface and fore part of coronoid process of inferior maxilla as far as last molar(F) (Inferior maxillary).

PTERYGO-MAXILLARY REGION.

External pterygoid : pterygoid ridge of great wing of sphenoid, outer surface of external pterygoid plate(F)—pterygoid depression in front of condyle of inferior maxilla, and inter-articular fibro-cartilage of temporo-maxillary joint(F) (Inferior maxillary).

Between sphenoidal and pterygoid attachments, the internal maxillary artery dips down to reach spheno-maxillary fossa, and the buccal nerve appears.

Internal pterygoid : inner surface of external pterygoid plate, tuberosities of palate bone, and superior maxilla(F)—angle and inner surface of ramus of inferior maxilla(F) (Inferior maxillary).

On muscle are dental and gustatory nerves, dental artery, and internal lateral ligament of jaw.

SUPERFICIAL CERVICAL REGION.

Platysma myoides: clavicle and acromion, fascia covering deltoid, pectoralis major, and trapezius(F)—*Inner fibres.* Blend with opposite platysma. *Outer fibres.* Prolonged to angle of mouth(F)—(Facial, Superficial cervical). *The highest fibres of this muscle form the risorius.*

Sterno-cleido-mastoid: *Inner head.* Anterior part of 1st piece of sternum(T). *Outer head.* Inner ⅓ of superior border clavicle(F)—external surface of mastoid process from base to apex(T), rough temporal ridge, and outer ⅔ of superior curved line of the occiput(A) (Spinal accessory, Cervical plexus).

Forms anterior boundary of posterior and posterior boundary of anterior triangles of neck. Clavicular origin conceals: anterior scalenus, omo-hyoid. *Sternal origin conceals:* depressors of hyoid bone, common carotid vessels and nerve. *Union of two heads conceals:* middle scalenus, levator anguli scapulæ, cervical plexus. *Near insertion conceals:* splenius, digastricus, occipital artery, part of parotid.

INFRA-HYOID REGION.

Sterno-hyoid: posterior surface of sternum, cartilage of 1st rib(F)—lower border of body of hyoid bone(A) (Communicating branches between descendens and communicans noni).

Sterno-thyroid: posterior surface of sternum, cartilage of 1st rib(F)—oblique line on side of thyroid cartilage(F) (Communicating branches between descendens and communicans noni).

Thyro-hyoid: oblique line on side of thyroid cartilage(F) [illegible]—internal half of greater cornu and outer part of body of [illegible]d bone(F) (Hypo-glossal).

O[illegible]hyoid : upper border of scapula, behind notch and ligament over notch(F)—lower part of body of hyoid bone(F) (Communicating branches between descendens and communicans noni).

SUPRA-HYOID REGION.

Digastric : *Posterior belly.* Groove on internal surface of mastoid process(F). *Anterior belly.* Posterior surface of inferior maxilla, by side of symphysis(F)—intervening tendon(T), which is bound down to hyoid bone by fascia (*anterior*, Mylo-hyoid of inferior dental; *posterior*, Facial).

Stylo-hyoid : outer and middle part of styloid process(F) —body of hyoid bone(T) (Facial). *Perforated by tendon of digastricus.*

Mylo-hyoid : mylo-hyoid ridge on inner surface of inferior maxilla(F)—middle of body of hyoid bone, and joins fellow at median line(A) (Mylo-hyoid of inferior dental).

Parts beneath the mylo-hyoid : sublingual and part of submaxillary gland, with Wharton's duct; genio-hyoid, genio-hyo-glossus, hyo-glossus, stylo-glossus muscles, sublingual and ranine arteries, gustatory, hypoglossal nerves; and submaxillary ganglion.

Genio-hyoid : inferior genial tubercle on posterior surface near symphysis of inferior maxilla(T)—middle of body of hyoid bone(A) (Hypoglossal).

LINGUAL REGION.

Genio-hyo-glossus : superior genial tubercle on posterior surface near symphysis of inferior maxilla(T)—body of hyoid bone(F) (posterior fibres)—inferior surface of tongue from root to tip(F) (anterior fibres) (Hypoglossal).

Hyo-glossus : side of body and all great cornu of hyoid(F)—back and side of tongue(F) (Hypoglossal).

Parts beneath hyo-glossus : superficial lingual, genio-hyo-glossus and middle constrictor muscles, lingual vessels, stylohyoid ligament, glosso-pharyngeal nerve.

Stylo-glossus: external surface of apex of styloid process and stylo-maxillary ligament(A)—dorsum and tip of tongue(F) (Hypoglossal).

PHARYNGEAL REGION.

Inferior constrictor: side of cricoid cartilage; oblique line and cartilage behind, superior and inferior borders of thyroid cartilage(F)—fibrous *raphé* in posterior median line of pharynx(F) (Pharyngeal plexus, Glosso-pharyngeal, External laryngeal).

Middle constrictor: great and small cornua of hyoid bone, stylo-hyoid ligament(F)—fibrous *raphé* in posterior median line of pharynx(F) (Pharyngeal plexus, Glosso-pharyngeal).

Superior constrictor: lower 3rd of inner margin of internal pterygoid plate, pterygo-maxillary ligament, posterior part of mylo-hyoid ridge of inferior maxilla, mucous membrane of mouth and side of tongue(F)—fibrous *raphé* in posterior median line of pharynx(F) (Pharyngeal plexus Glosso-pharyngeal).

Stylo-pharyngeus: inner surface of base of styloid process(F)—pharynx and upper border of thyroid cartilage(F) (Pharyngeal plexus, Glosso-pharyngeal). *Passes between external and internal carotid arteries.*

Salpingo-pharyngeus: lower edge of cartilage of Eustachian tube(F)—palato-pharyngeus(F).

PALATAL REGION.

Levator palati: apex of under surface of petrous portion of temporal, inner and posterior part of cartilage of Eustachian tube(F)—middle line of soft palate(F) (Pharyngeal branches of ascending pharyngeal).

Tensor palati: scaphoid fossa of sphenoid, outer and anterior part of Eustachian tube, spinous process of sphenoid, vaginal process of temporal(F) (*turns round hamular* *process*)—posterior border of hard palate, aponeurosis of soft palate(A) (Otic ganglion).

Azygos uvulæ : posterior nasal spine of palate bone(F)—tip of uvula(F) (Pharyngeal branches of ascending pharyngeal).

Palato-glossus (*anterior pillar of soft palate*) : side and dorsum of tongue(F)—anterior and lateral surface of soft palate(F) (Meckel's ganglion).

Palato-pharyngeus (*posterior pillar of soft palate*) : posterior border of thyroid cartilage pharynx(F)—*Anterior fibres*, join opposite muscle at middle line going between the levator and tensor. *Posterior fibres*, join opposite fellow at middle line(F) (Meckel's ganglion).

INTRA-LARYNGEAL REGION.

Crico-thyroideus : front and side of cricoid cartilage(F)—lower cornu and lower border of thyroid cartilage(F) (Superior laryngeal).

Thyro-arytænoideus : posterior surface of thyroid cartilage near median line, thyroid ligament(F)—anterior surfaces of arytænoid cartilage(F) (Inferior laryngeal).

Crico-arytænoideus lateralis : side of superior border of cricoid cartilage(F)—projection at external angle of base of arytænoid cartilage, and contiguous external surface(F) (Inf. laryngeal).

Crico-arytænoideus posticus : posterior surface of cricoid cartilage(F)—projection at external angle of base of arytænoid cartilage(F) (Inf. laryngeal).

Arytænoideus : single muscle in the median line, fills up posterior concave surface of arytænoid cartilages (Superior and Inferior laryngeal).

ANTERIOR VERTEBRAL REGION.

Rectus capitis anticus major : four tendinous slips from anterior tubercles of transverse processes of 6th, 5th, 4th, 3rd cervical vertebræ(T)—basilar process of occipital(F) (Sub-occipital, Cervical plexus).

Rectus capitis anticus minor: anterior transverse process and body of atlas(F)—basilar process of occipital(F) (Sub-occipital, Cervical plexus).

Rectus lateralis: superior surface of transverse process of atlas(F)—jugular process of occipital (Sub-occipital). *Highest intertransverse muscle.*

Longus colli: *Superior oblique part.* Anterior tubercles of transverse processes of 3rd, 4th, 5th cervical vertebræ(T)—tubercle on anterior arch of atlas(T). *Inferior oblique part.* Bodies of first three dorsal(F)—transverse processes of 5th and 6th cervical(T). *Vertical part.* Bodies of lower three cervical and upper three dorsal(F)—bodies of 2nd, 3rd, and 4th cervical vertebræ(T) (Lower cervical nerves).

LATERAL VERTEBRAL REGION.

Scalenus anticus: inner border and superior surface of 1st rib (scalene tubercle)(T)—anterior tubercles of transverse processes of 6th, 5th, 4th, 3rd cervical vertebræ(T) (Branches of lower cervical). *Phrenic nerve lies along anterior surface, subclavian artery passes behind at origin.*

Scalenus medius: rough elevation on superior border of 1st rib, behind groove for subclavian artery(F)—posterior transverse processes of all cervical vertebræ(T) (Branches of lower cervical).

Scalenus posticus: superior border of 2nd rib(T)—transverse processes of lower two or three cervical vertebræ(T) (Branches of lower cervical).

POSTERIOR VERTEBRAL REGION.

Rectus capitis posticus major: spinous process of axis(T)—outer ⅓ inferior curved line of occiput(F) (Great occipital).

Rectus capitis posticus minor: posterior surface of neural arch of atlas(T)—inner part of inferior curved line of occiput(F) (Great occipital).

Obliquus inferior: spinous process of axis(F)—transverse process of atlas(T) (Great occipital).

Obliquus superior : superior surface of transverse process of atlas(T)—occipital bone, between the two curved lines(F) (Great occipital).

MUSCLES OF UPPER EXTREMITY.

ANTERIOR THORACIC REGION.

Pectoralis major : *superiorly*, sternal half of clavicle(F); *internally*, front of sternum, cartilages of upper six ribs(F). Inferiorly, aponeurosis of external oblique muscle of abdomen(F)—anterior ridge of bicipital groove of humerus(T) (External anterior thoracic). *Anterior boundary of axilla, separated from the deltoid above, by cephalic vein and branch of acromial thoracic artery.*

Pectoralis minor: 3rd, 4th, and 5th ribs outside cartilages, aponeurosis over intercostal muscles(F)—anterior ½ of superior surface and inner border of coracoid process of scapula(T) (Internal anterior thoracic). *Forms middle 3rd of anterior axillary boundary, and conceals axillary vessels and nerves.*

Subclavius : 1st rib at junction of bone and cartilage(T)—groove on under surface of clavicle between the two tubercles(F) (Branch from 5th and 6th cervical). *Encased by costo-coracoid sheath.*

LATERAL THORACIC REGION.

Serratus magnus : eight or nine digitations from as many ribs, the 1st digitation being attached to 1st and 2nd ribs, aponeurosis over intercostal muscles ; lower four slips digitate with external oblique muscle of abdomen(F)—vertebral border of costal surface of scapula ; viz., digitation from 1st and 2nd ribs to upper angle, from 3rd and 4th ribs to base ; the rest to inferior angle(F) (Posterior thoracic).

ACROMIAL REGION.

Deltoideus : outer ⅓ anterior border of clavicle, anterior edge of acromion, all lower edge of spine of scapula(F)—rough deltoid impression on outer surface of humerus just above the middle(T) (Circumflex).

Parts covered by deltoid: head and neck of humerus; bursa between head of humerus and muscle; circumflex vessels and nerve; tendons of insertion of subscapularis, pectorales major and minor, teretes major and minor, latissimus dorsi, supra-spinatus, infra-spinatus. Origins of coraco-brachialis, biceps (two heads), triceps (long and outer heads): capsular, coraco-acromial, humeral, clavicular costo-coracoid (external part) ligaments; coracoid process; acromial thoracic, and branch of superior profunda vessels.

ANTERIOR SCAPULAR REGION.

Subscapularis : all subscapular fossa, except at neck, angles, and inner border(F T A)—small tuberosity of humerus(T) and for one inch below(F) (Subscapular). *Bursa placed between the tendon and root of coracoid process, communicating with shoulder joint.*

POSTERIOR SCAPULAR REGION.

Supra-spinatus : supra-spinous fossa, except near neck of scapula; upper side of spine, and fascia covering muscle(F)—upper of three facets upon great tuberosity of humerus(T) (Supra-scapula).

Infra-spinatus : infra-spinous fossa, except at neck, axillary border, and inferior angle; from inferior surface of spine of scapula, and fascia covering muscle(F)—middle of three facets on great tuberosity of humerus(T) (Supra-scapular).

Teres minor : dorsum of scapula, from superior ⅔ of axillary border, investing fascia(F)—lowest of three facets upon great tuberosity of humerus(T) (Circumflex, *has a gangliform swelling on it*). *Dorsal branch of subscapular artery, bends backwards over this muscle to reach infra-spinal fossa.*

Teres major: dorsum of scapula, from rough surface at inferior angle, and axillary border for lower ⅓, fascia covering teres minor(F)—inner edge of bicipital groove of humerus(T) (Subscapular). *A bursa is placed between tendon and humerus posteriorly, and between tendon and latissimus dorsi insertion anteriorly.*

ANTERIOR HUMERAL REGION.

Coraco-brachialis: apex of coracoid process of scapula, tendon of coracoid head of biceps(F)—rough ridge near middle of inner side of humerus(T) (Musculo-cutaneous). *Brachial vessels to inner side.*

Biceps: *Long or glenoid head.* Just above glenoid cavity, within the shoulder joint(T). *Short or coracoid head.* Apex of coracoid process of scapula(T)—rough and hinder part of tubercle of radius(T) and fascia of forearm (Musculo-cutaneous). *A bursa is placed on the smooth and fore part of tubercle. Inner border, the guide to brachial vessels below middle of humerus.*

Brachialis anticus: lower half of anterior surface of shaft of humerus, inner and upper part of outer intermuscular septa(F)—under surface of coronoid process of ulnar(T) (Musculo-cutaneous, Musculo-spiral). *Brachial artery, median, musculo-spiral and musculo-cutaneous nerves lie on it.*

POSTERIOR HUMERAL REGION.

Triceps: *Long or middle head.* Depression on vertebral border of scapula, close beneath glenoid cavity(T). *External head.* From root of great tuberosity to musculo-spiral groove on posterior surface of humerus(F). *Internal head.* Posterior surface of shaft of humerus, by side of and below muscular spiral groove, internal and external intermuscular septa(F)—posterior surface of olecranon process of ulna(T) (Musculo-spiral). *Bursa is placed between the tip of process and tendon.*

Sub-anconeus: by two fasciculi just above olecranon fossa of humerus(F)--synovial sac of elbow joint(F) (Musculo-spiral).

ANTERIOR BRACHIAL REGION, SUPERFICIAL LAYER.

Pronator radii teres : *Humeral head.* Internal supra-condyloid ridge of humerus, internal condyle of humerus by common flexor tendon. *Ulnar head.* Inner border of coronoid process of ulna, fascia and septum(F)—rough impression about middle of outer surface of radius(T) (Median). *Median nerve enters forearm through the two heads of origin.*

Flexor carpi radialis : common flexor tendon from internal condyle of humerus(T), aponeurosis of forearm, intermuscular septum(F)—bases of 2nd and 3rd metacarpal bones(T) (Median). *External edge of muscle, guide to radial artery. Passes through groove in os trapezium, and has special sheath of annular ligament.*

Palmaris longus : common flexor tendon from internal condyle of humerus(T), aponeurosis of forearm(F), intermuscular septa(F)—Palmar fascia, and a slip to short muscles of thumb(T) (Median). *Passes over annular ligament.*

Flexor carpi ulnaris : *Humeral head.* Common flexor tendon from internal condyle of humerus(T). *Ulnar head.* Inner side of olecranon. upper ¾ of ridge between internal and posterior surfaces of ulna(A)--Pisiform bone and prolonged to base of 5th metacarpal and hook of unciform bone(T). (Ulnar) *Radial side of muscle guide to ulnar artery. Ulnar nerve enters forearm through two heads of origin.*

Flexor sublimis digitorum, *vel.* **perforatus** : *Humeral head.* Common flexor tendon from internal condyle of humerus(T), internal lateral ligament(F), intermuscular septum(F). *Ulnar head.* Inner side of coronoid process of ulna. *Radial head.* Oblique line of radius, below tubercle(A)—sides of middle phalanges of fingers, tendon being split for flexor profundus digitorum(T) (Median). *Tendons pass under annular ligament, in pairs, middle and ring-finger ones anterior, those for index and little fingers posterior.*

ANTERIOR BRACHIAL REGION.

Flexor profundus digitorum, *vel.* **perforans** : upper ¾ of anterior and internal surfaces of shaft of ulna, upper ¾ of ulnar half of interosseous membrane, aponeurosis from ridge of ulna(F)—bases of last phalanges(T) (*Inner half,* Ulnar ; *Outer half,* Anterior interosseous of median). *Tendons pass beneath annular ligament.*

Flexor longus pollicis : hollow on upper ⅔ of anterior surface of shaft of radius, outer ½ of interosseous membrane for same distance(F) ; base of coronoid process of ulna by a separate slip(F)—base of last phalanx of thumb(T) (Anterior interosseous). *Tendon passes beneath the annular ligament.*

Pronator quadratus : anterior and inner surfaces of shaft of ulna, for lower fourth(F)—for two inches into lower end anterior surface and external border of radius(F) (Anterior interosseous).

RADIAL REGION.

Supinator longus: upper ⅔ external supra-condyloid ridge of humerus, external intermuscular septum(F)—root of styloid process of radius(T) (Musculo-spiral).

Extensor carpi radialis longior : lower ⅓ of external supra-condyloid ridge of humerus, external intermuscular septum(F)—base of posterior surface of metacarpal of index finger(T) (Musculo-spiral). *Passes over groove, posterior to styloid process of radius.*

Extensor carpi radialis brevior : common extensor tendon from external condyle of humerus(T), external lateral ligament, external intermuscular septum(F)—base of metacarpal bone of middle finger(T) (Posterior interosseous).

POSTERIOR BRACHIAL REGION, SUPERFICIAL LAYER.

Extensor communis digitorum : common extensor tendon from external condyle of humerus(T) ; intermuscular septum(T)—dorsa of last two phalanges of fingers(T) (Posterior interosseous). *The three tendons pass through a separate compartment of the annular ligament with the extensor indicis; below the ligament the internal tendon splits into two for the two inner fingers.*

Extensor minimi digiti: common extensor tendon from external condyle of humerus(T)—2nd and 3rd phalanges of little finger(T) (Posterior interosseous). *Tendon passes through separate sheath of annular ligament, below which it splits into two, the external one being united by a cross piece with the tendon of common extensor going to little finger.*

Extensor carpi ulnaris: common extensor tendon from external condyle of humerus(T), intermuscular septum(F) by aponeurosis from middle 3rd of posterior border of ulna(A)—prominence on ulnar side of base of 5th metacarpal bone(T) (Posterior interosseous). *Has separate sheath in annular ligament.*

Anconeus: posterior surface of external condyle of humerus(T)—outer side of olecranon, impression on upper 3rd of posterior surface of ulna(F) (Musculo-spiral). *The recurrent interosseous vessels lie beneath this muscle.*

POSTERIOR BRACHIAL REGION.

Supinator brevis: external lateral ligament of elbow-joint, orbicular ligament of radius, depression below lesser sigmoid cavity, external edge of ulna for 2 in.(F)—surrounds upper 3rd of radius, viz., to neck, upper ⅓ posterior surface, upper ½ of external surface of radius(F) (Posterior interosseous).

Extensor ossis metacarpi pollicis middle 3rd of posterior surface of shaft of radius, special impression on superior and external part of posterior surface of ulna for same length, intervening interosseous membrane(F)—base of 1st metacarpal, slip to os trapezium(T) (Posterior interosseous). *The radial artery winds backwards beneath tendon near carpus.*

Extensor primi internodii pollicis: posterior surface of radius and interosseous membrane below preceding muscle for about 1½ in. (F)—base of 1st phalanx of thumb(T) (Posterior interosseous). *Goes through groove of annular ligament with extensor ossis metacarpi pollicis.*

Extensor secundi internodii pollicis: posterior surface of ulna, below anconeus and internal to extensor ossis metacarpi pollicis for four inches, interosseous membrane(F)—base of last phalanx of thumb(T) (Posterior interosseous). *Tendon goes through separate sheath of annular ligament, and below is separated from other extensors of thumb by a triangular interval, which contains the radial artery.*

Extensor indicis: internal part of posterior surface of shaft of ulna for about 3 inches just below middle, and interosseous membrane(F)—joins tendon of extensor communis digitorum to 2nd and 3rd phalanges of index finger(T) (Posterior interosseous).

THUMB, RADIAL REGION.

Abductor pollicis: ridge of trapezium, upper part of annular ligament(F)—outer side of base of 1st phalanx of thumb(T) (Median).

Opponens pollicis: anterior surface and ridge of trapezium, annular ligament(F)—whole length of radial side of shaft of 1st metacarpal(F).

Flexor brevis pollicis: anterior surfaces of trapezoid, os magnum, and bases of 2nd and 3rd metacarpal bones, lower part of annular ligament(F)—By two heads into radial and ulnar sides of base of 1st phalanx of thumb(T). (*Outer part*, median; *Inner part*, ulnar.) *A sesamoid bone developed in each tendon of insertion. Deep palmar arch of radial, issues from beneath inner head.*

Adductor pollicis: anterior edge of shaft of 3rd metacarpal(F)—ulnar side of base of 1st phalanx of thumb(T) (Ulnar).

LITTLE FINGER, ULNAR REGION.

Palmaris brevis: annular ligament, palmar fascia(F)—skin on ulnar side of palm(F) (Ulnar).

Adductor, *vel.* **opponens, minimi digiti**: process of unciform bone, lower part of annular ligament(F) ulnar edge of 5th metacarpal(F) (Ulnar).

Flexor brevis minimi digiti: tip of process of unciform, annular ligament(F)—ulnar side of base of 1st phalanx of little finger(T) (Ulnar).

Abductor minimi digiti: pisiform bone, tendon of flexor carpi ulnaris(F)—ulnar side of base of 1st phalanx of little finger(T) (Ulnar).

MIDDLE PALMAR REGION.

Lumbricales (4): radial side of deep flexor tendons (2 inner from ulnar margins of 2nd and 3rd tendons also)(F)—tendinous expansion on dorsa of 1st phalanges of fingers(T) (2 *outer* median, 2 *inner* ulnar.) *Proceed along radial side of fingers.*

Interossei dorsales (4): *Abduct from median line of hand.* 1st muscle (*abductor indicis*): *Outer head.* From upper ½ of ulnar border of 1st metacarpal(F). *Inner head.* Radial border of 2nd metacarpal(F). The others from dorsa of both metacarpals, between which they lie.—1st and 2nd muscles to radial side of 1st phalanx of index and middle fingers respectively, 3rd and 4th in similar manner to ulnar side of middle and ring fingers(T). All join expansion on 1st phalanx of common extensor(T) (Ulnar).

Interossei palmares (3): *Adduct to median line of hand.* 1st from ulnar side of 1st metacarpal, 2nd and 3rd from radial sides of 4th and 5th metacarpals respectively(F)—1st phalanx of finger from which they arise and on the same side as the origin(T) (Ulnar).

MUSCLES OF BODY.

BACK, 1ST LAYER.

Trapezius : spinous processes of all dorsal and 7th cervical vertebræ, with supra-spinous ligament, ligamentum nuchæ, inner 3rd of superior curved line of occiput(T)—outer 3rd of posterior surface of clavicle, superior edge of acromion, superior border of spine of scapula, and rough impression on spine about 1 in. from root(T) (Spinal accessory, Cervical plexus). *Anterior fibres form posterior boundary of posterior triangle of neck.*

Latissimus dorsi : spinous processes of lower 6 dorsal, all lumbar, 1st and 2nd sacral vertebræ, with supra-spinous ligaments(A), outer edge of posterior half of iliac crest(A), lower 3 or 4 ribs(F)—bottom of bicipital groove of humerus(T) (Subscapular). *The attachment to the ribs is fleshy, and digitates with like processes of the external oblique. In the back it is posterior to the teres major, but twisting upon itself it is inserted anteriorly to it.*

BACK, 2ND LAYER.

Levator anguli scapulæ : posterior transverse processes of upper three or four cervical vertebræ(T)—vertebral border of scapula between spine and superior angle(F) (5th cervical). *Forms part of floor of posterior triangle of neck.*

Rhomboideus minor : ligamentum nuchæ, spinous processes of 7th cervical and 1st dorsal vertebræ(F)—vertebral border of scapula, opposite root of spine(F) (5th cervical).

Rhomboideus major : spines and supra-spinous ligament of upper 4 or 5 dorsal vertebræ, below preceding(T)—vertebral border of scapula between spine and inferior angle(F) (5th cervical). *Sometimes the fibres end in a tendinous arch near the bone.*

BACK, 3RD LAYER.

Serratus posticus superior : ligamentum nuchæ, spinous processes of 7th cervical and superior two or three dorsal vertebræ(A)—upper borders of 2nd, 3rd, 4th, and 5th ribs external to angles(F) (External posterior branches of cervical).

Serratus posticus inferior: spinous processes of 11th and 12th dorsal, 1st, 2nd, and 3rd lumbar vertebræ, and united to tendon of origin of latissimus dorsi and fascia lumborum(A)—inferior borders of lower four ribs external to angles(F) (External branches of dorsal).

Splenius: ligamentum nuchæ, spinal processes of 7th cervical and upper 6 dorsal vertebræ(A)—*capitis*, apex and hinder border of mastoid process, outer ⅓ superior curved line occiput(T); *colli*, posterior transverse processes of 1st, 2nd, and 3rd cervical vertebræ(T) (External posterior branches of cervical).

BACK, 4TH LAYER.

Erector spinæ: *Outer mass.* Sacro-lumbalis, musculus accessorius, cervicalis descendens. *Inner mass.* Longissimus dorsi, transversalis colli, trachelo-mastoid.

Erector spinæ: posterior 5th inner lip of iliac crest, transverse processes(A) and tubercles of all the lumbar vertebræ(T), fascia(F)—sacro-lumbalis, longissimus dorsi (External posterior branches of sacral and lumbar.)

Sacro-lumbalis, *vel.* **Ileo-costalis**: erector spinæ(F)—angles of lower 6 or 7 ribs(T) (External posterior branches of lumbar and dorsal).

Musculus accessorius: angles of lower 6 ribs(T)—angles of upper 6 ribs, transverse process of 7th cervical(T) (External posterior branches of dorsal).

Cervicalis ascendens: angles of 3rd, 4th, 5th, and 6th ribs(T)—posterior transverse tubercles of 6th, 5th, and 4th cervical vertebræ(T) (External posterior branches of cervical).

Longissimus dorsi. *See erector spinæ, of which it forms nearly the whole of the inner mass.—Internally.* Transverse processes of all dorsal vertebræ(T). *Externally.* To all the ribs except first two or three, fleshy processes between tubercle and angle(F) (External posterior branches of lumbar and dorsal).

Transversalis colli : transverse processes of upper 6 dorsal vertebræ(T)—transverse processes of 6th, 5th, 4th, and 3rd cervical vertebræ(T) (External posterior branches of cervical)

Trachelo-mastoideus : transverse processes of upper six dorsal vertebræ(T), articular processes of 7th, 6th, 5th, and 4th cervical vertebræ(T)—superior half of posterior part of mastoid process(F) (External posterior branches of cervical).

Spinalis dorsi : spinous processes of 11th and 12th dorsal and 1st and 2nd lumbar vertebræ(FT)—spinous processes of upper half or ⅔ of dorsal vertebræ(T) (External posterior branches of dorsal and lumbar).

Spinalis cervicis : spinous processes of 5th and 6th cervical vertebræ(FT)—spine of axis(T) (*sometimes into 3rd and 4th cervical vertebræ*) (External posterior branches of cervical). *This muscle is frequently wanting.*

Complexus: transverse processes of upper six dorsal, articular processes of inferior 5, and spinous process of 7th cervical vertebræ(T)—impression between superior and inferior curved lines of occiput(F) (Internal posterior branches of cervical, Sub-occipital, Great occipital). *The inner part of this muscle is described sometimes as a separate muscle called biventer cervicis.*

BACK, 5TH LAYER.

Semi-spinalis dorsi : transverse processes of 10th, 9th, 8th, 7th, and 6th dorsal vertebræ(T)—spinous processes of upper four dorsal and last two cervical vertebræ(T) (Internal posterior branches of dorsal).

Semi-spinalis colli: transverse processes of upper six dorsal and articular processes of lower four cervical vertebræ(FT)—spinous processes of 2nd, 3rd, 4th, and 5th cervical vertebræ(T) (Internal posterior branches of cervical).

Multifidus spinæ : back of sacrum as low as 4th sacral foramen ; inner surface of superior posterior iliac spine, posterior sacro-iliac ligaments, articular processes of lumbar, transverse processes of dorsal, articular processes of lower five cervical vertebræ(FT)—spines and neural arches of vertebræ from 3rd sacral to 2nd cervical(F) (Internal posterior branches of sacral, lumbar, dorsal and cervical). *Fills groove on either side of spinous processes of vertebræ.*

Rotatores spinæ, *vel.* **dorsi** (eleven in number): tip and upper edge of transverse process of a dorsal vertebræ(F)—lower border of lamina of vertebra next above(A) (Internal posterior branches of dorsal).

Supra-spinales: series of fleshy bands lying upon spinous processes of cervical vertebræ(F) (Internal posterior branches of cervical).

Inter-spinales: placed in pairs, one on each side of interspinous ligament between spinous processes (Internal posterior branches of cervical, dorsal, and lumbar). *These muscles are wanting between 1st and 2nd cervical, and all the dorsal except first and last two pairs.*

Inter-transversales: lie between transverse processes. *Cervical* (seven pairs, two sets). One set attached to anterior, the other to the posterior tubercles. *Dorsal.* Single sets, from three to six in number, attached to the lower processes. *Lumbar.* Four in number, the lower ones filling up the spaces between processes entirely (Internal posterior branches of cervical, dorsal, and lumbar).

Extensor coccygis: lower end of sacrum(T)—inferior part of coccyx(F). *Frequently absent; lies upon posterior surface.*

ABDOMINAL REGION.

Obliquus abdominis externus: eight digitations from inferior borders of eight lower ribs, upper five digitating with serratus magnus, lower three with latissimus dorsi(F)—anterior half external lip of iliac crest, and aponeurosis in front of belly, which is attached to pubic spine and symphysis(A), ending at the *linea alba*, the rest of the fibres forming *Poupart's* and *Gimbernat's ligaments*(A) (Inferior intercostal, Ilio-hypogastric, and Ilio-inguinal). *External abdominal ring formed by a divergence of some of the lower fibres of aponeurosis.*

Obliquus internus: outer half Poupart's ligament, anterior ⅔ middle lip of iliac crest, fascia lumborum between iliac crest and 12th rib(F)—inferior edges of cartilages of lower three ribs on posterior surface, aponeurosis blending with its fellow at linea aspera; some of the lower fibres arch over spermatic cord, joining tendon of transversalis just above pectineal line, and called *conjoined tendon*, which is attached to pectineal line and front of pubes(T) (Inferior intercostals, Ilio-hypogastric, Ilio-inguinal). *Aponeurosis forms sheath to encase the rectus except at lower fourth.*

Cremaster (*peculiar to male*): Poupart's ligament and internal oblique(F)—crest of os pubis(T) (Ilio-inguinal).

Transversalis: outer ⅓ Poupart's ligament, anterior ⅔ inner lip iliac crest, posterior surfaces of cartilages of lower six ribs(F), fascia lumborum(T)—lower fibres end in the *conjoined tendon*, inserted into pubis and pectineal line(T), rest of fibres terminate in an aponeurosis attached to linea alba(A) (Inferior intercostals, Ilio-hypogastric, Ilio-inguinal). *As low as midway between pubes and umbilicus, the aponeurosis is posterior [illegible] the rectus, but beyond that spot it is anterior.*

Posterior aponeurosis or fascia lumborum occupies interval between iliac crest and last two ribs; meeting with the quadratus lumborum muscle internally, it splits to enclose it; the posterior sheath being the stronger, and forming the anterior layer of aponeurosis enclosing erector spinæ.

Rectus abdominis: pubic crest and symphysis(T)—ensiform appendix, cartilages of 6th and 7th ribs, bone and cartilage of 5th rib(F) (Inferior intercostal, Ilio-hypogastric, Ilio-inguinal). Traversed by three or four tendinous intersections, *lineæ transversæ*. *Sheath of rectus*. Aponeurosis of internal oblique splits at outer edge of muscle, one piece passing anteriorly, the other posteriorly. The posterior part is deficient at upper and lower fourths, and is joined by aponeurosis of transversalis; the lower border forms the *Fold of Douglas*. The anterior part blends with aponeurosis of the external oblique.

Pyramidalis: front of pubes(T)—linea alba(T) midway between umbilicus and pubes (Ilio-hypogastric). *Enclosed in sheath of rectus, and frequently absent.*

Quadratus lumborum: ilio-lumbar ligament and inner lip of iliac crest for one inch external to it(A)—transverse processes of upper four lumbar, body of 12th dorsal vertebræ(T), inferior border of 12th rib(F) (Anterior branches of lumbar).

THORACIC REGION.

Intercostales externi (11): outer lip of groove on inferior border of rib, from the tubercle to costal cartilage(F)—outer edge of superior border of rib below(F) (Intercostal). *Fibres run downwards and forwards.*

Intercostales interni (11): inner lip of groove on inferior border of rib, extending from angle to sternum(F)—inner edge of superior border of rib below (Intercostal). *Fibres run downwards and backwards, but not so obliquely as the external muscles. The intercostal vessels and nerve lie between the external and internal muscles.*

Infracostales (10): inner surface of a rib, near angle(F)—inner surface of 1st, 2nd, or 3rd ribs below(FT) (Intercostal).

Triangularis sterni: side of ensiform appendix and sternum, as high as 3rd intercostal space, posterior surfaces of cartilages of 7th, 6th, and 5th ribs(F)—posterior surfaces of 2nd, 3rd, 4th, and 5th ribs at junction of bone and cartilage, aponeurosis posterior to internal intercostal muscles(TF) (Anterior branches of intercostal).

Levatores costarum (12): apex and lower border of transverse process of a dorsal vertebra(T)—superior border of rib below, extending from tubercle to angle(F) (Intercostal). *1st muscle arises from 7th cervical vertebra, and is inserted into outer border of 1st rib.*

DIAPHRAGMATIC REGION.

Diaphragma: posterior surface of ensiform appendix, internal surfaces of lower six ribs(F), ligamenta arcuata(A) (externa et interna). Right crus, from bodies and intervertebral substances of 1st, 2nd, 3rd lumbar vertebræ(T). Left crus, bodies and intervertebral substances of 1st and 2nd lumbar vertebræ(T)—central tendon (Phrenic).

Openings. AORTIC: between the crura and spine, and transmits aorta, thoracic duct, and vena azygos major. ŒSOPHAGEAL: above and little to left of aortic, transmits œsophagus and pneumogastric nerves. VENA CAVA: in the right leaflet of tendon, transmits vena cava inferior, which is inseparately united to it. In each crus there is a fissure for the three splanchnic nerves, the left one passing in addition the vena azygos minor.

PERINEAL REGION.

Sphincter ani (externus): tip of coccyx and sub-cutaneous fatty layer on either side(F)—central perineal tendon(F) (Hæmorrhoidal branch of 4th sacral).

Sphincter ani internus: the involuntary muscular fibres of the large intestine thickened about ½ inch deep.

Accelerator, *vel.* **ejaculator urinæ**: central perineal tendon and *raphé* (F)—*Posterior fibres.* Anterior surface of triangular ligament(F). *Anterior fibres.* Sides of corpus cavernosum, and united with one on opposite side it encases dorsal vessels(F) (Muscular of perineal).

Erector penis; internal surface of tuber ischii(TF)—internal and external surfaces of crus penis(T) (Muscular of perineal).

Transversus perinæi: internal surface of pubic arch near tuber ischii(T)—central perineal tendon(F) (Muscular of perineal).

Levator ani: posterior surface of pubes near symphysis, spine of ischium, between these two points from pelvic fascia, along attachment of obturator fascia(F)—central perineal tendon, sides of rectum and coccyx(F) (Superficial perineal, Anterior 4th sacral). *Forms floor of pelvic cavity.*

Compressor urethræ: internal surface of pubic arch, posterior surface of triangular ligament(A)—muscle of opposite side(T) (Muscular of perineal). *Surrounds membranous portion of urethra.*

Coccygeus: upper part of ischial spine, small sacro-sciatic ligaments(TF)—side and anterior surface of coccyx and last piece of sacrum(F) (4th and 5th anterior sacral).

Note.—In the female the perinæal muscles are essentially the same: for erector penis, read *erector clitoridis*, inserted into side of clitoris. The *sphincter vaginæ* corresponding to ejaculator urinæ.

MUSCLES OF LOWER EXTREMITY.

ILIAC REGION.

Psoas magnus: transverse processes and sides, bodies of all the lumbar and body of 12th dorsal vertebræ(F) (the fleshy fibres are only attached to upper and lower margins of bodies, and intervertebral substances, being connected by a tendinous arch between)—small trochanter of femur, receiving some fibres from the iliacus(T) (Branches from lumbar plexus).

Psoas parvus: bodies of 12th dorsal and 1st lumbar vertebræ and intervertebral disc(F)—ilio-pectineal line(T) (Branch from lumbar plexus). *Frequently absent.*

Iliacus: iliac fossa, ilio-lumbar ligament(?), base of sacrum, and capsule of hip joint(F)—tendon of psoas, triangular surface anterior to and below the small trochanter(F) (Anterior crural). *Passes beneath Poupart's ligament with the psoas.*

ANTERIOR FEMORAL REGION.

Tensor vaginæ femoris: outer edge of iliac crest for one inch, anterior superior iliac spine and half notch below it(A)—fascia lata (ilio-tibial band) about ¼ down thigh, anterior to great trochanter(F) (Superior gluteal).

Sartorius: anterior superior iliac spine, and half notch below(A)—inner side of tibia, by side of tubercle, reaching by its upper edge as far back as internal lateral ligament(AT) (Middle or internal cutaneous of anterior crural). *Longest muscle of body, crosses thigh obliquely, forming outer boundary of Scarpa's triangle and roof of Hunter's canal, lower tendon pierced by patellar branch of great saphenous nerve.*

Triceps extensor: composed of:—

Vastus externus: upper half of shaft of femur, thus: from base of neck, anterior and outer parts of base of great trochanter, and line from great trochanter to linea aspera, upper half of external lip of linea aspera, external intermuscular septum(AF)—common extensor tendon, and slip to outer side of patella(T) (Anterior crural).

Vastus internus: anterior and internal surfaces of shaft of femur, except where vastus externus is attached; thus it reaches superiorly to anterior intertrochanteric line, and inferiorly to end of shaft, laterally to external and internal intermuscular septum(AF)—common extensor tendon and slip to internal edge of patella(T) (Anterior crural).

Rectus femoris: *1st head.* Anterior inferior iliac spine(T). *2nd head.* Groove above acetabulum(T)—common extensor tendon into upper border of patella(T) (Anterior crural).

THE COMMON EXTENSOR TENDON is inserted into the upper and lateral edges of the patella, very few fibres being prolonged over bone to form the ligamentum patellæ.

Subcrureus: two slips from anterior surface of shaft of femur in lower fourth(F)—synovial sac of knee-joint(F) (Anterior crural).

INTERNAL FEMORAL REGION.

Gracilis: internal margin of pubic border of hip-bone; viz., opposite lower half of symphysis and upper half of pubic arch(A)—inner side of tibia superior to semi-tendinosus, but inferior to backward prolongation of insertion of Sartorius(T) (Anterior branch of obturator).

Pectineus: Ilio-pectineal line and triangular surface anterior to it(F)—posterior to small trochanter and upper half of line leading from it to linea aspera(T) (Anterior crural).

Adductor longus: anterior surface of pubes below angle of crest and symphysis(T)—inner lip of linea aspera(F) (Anterior division of obturator). *Forms internal boundary of Scarpa's triangle.*

Adductor brevis: ramus of pubes, extending from adductor longus to middle of ramus(FA)—behind pectineus into line leading from small trochanter to linea aspera(F) (Posterior division of obturator). *Anterior division of obturator nerve placed in front and posterior part behind, the internal circumflex artery between upper border and obturator externus.*

Adductor magnus : pubic arch from symphysis to tuber ischii(A)—*Anterior part*. Line from great trochanter to linea aspera, inner lip of linea aspera, upper half line leading to inner condyle(F). *Posterior part*. Tubercle above inner condyle(T) (Posterior division of obturator, Great sciatic).

Gluteus maximus : space between superior curved line and posterior ¼ of outer lip of iliac crest, aponeurosis over multifidus spinæ, posterior surfaces of coccyx and last piece of sacrum, and great sacro-sciatic ligament(F)—gluteal ridge between linea aspera and great trochanter(AF), fascia lata(F) (Small sciatic).

Parts beneath the gluteus maximus :-part of gluteus medius, the pyriformis, gemellus inferior and superior, quadratus femoris, upper part of adductor magnus, tendon of obturator internus, origins of semi-membranosus, semi-tendinosus, and biceps. Superficial branch of gluteal artery, sciatic vessels and nerves, pubic vessels and nerve, nerve to obturator. Three bursæ, one over great trochanter, one over tuber ischii, one over vastus externus. Great sacro-sciatic ligament. Great trochanter and tuber ischii.

Gluteus medius : external iliac crest and bone between crest super-curved line and middle curved line, fascia(F)—outer surface of great trochanter from base posteriorly to apex anteriorly(F) (Superior gluteal). *Conceals gluteal vessels and nerve.*

Gluteus minimus : posterior surface of hip-bone between middle and inferior curved lines(F)—impression on anterior part of great trochanter(F) (Superior gluteal).

Pyriformis : anterior surface of sacrum, from 2nd, 3rd, and 4th pieces between anterior foramina, upper margin of great sciatic notch, great sacro-sciatic ligament(F)—superior edge of great trochanter between gluteus maximus and minimus(T) (Sacral plexus). *Goes through great sacro-sciatic foramen.*

Obturator internus: posterior surfaces of pubic arch, obturator membrane, and bone behind; to small sciatic notch, fascia(F)—upper part of great trochanter with the gemelli(T) (Sacral plexus). *Passes through small sacro-sciatic foramen.*

Gemellus superior: outer surface of ischial spine(F)—superior border of great trochanter anterior to the pyriformis with obturator internus(T) (Sacral plexus).

Gemellus inferior: superior and outer border of tuber ischii(F)—superior border of great trochanter with obturator internus(T) (Sacral plexus).

Obturator externus: anterior half of outer surface of obturator membrane, rami of pubes and ischium(F)—digital fossa at root of great trochanter(T) (Obturator). *Fibres run obliquely outwards and backwards.*

Quadratus femoris: external border of tuber ischii(F)—tubercle on posterior inter-trochanteric ridge, and downwards as far as insertion of adductor magnus(F)—(Sacral plexus).

POSTERIOR FEMORAL REGION.

Biceps: *Long head.* Upper and inner impression on tuber ischii(T). *Short head.* Outer lip of linea aspera, upper part of line to external condyle, external intermuscular septum(F)—by two slips embracing the external lateral ligament upon the outer side of head of fibula(T) (Great sciatic). *Forms outer ham-string.*

Semi-tendinosus: upper and inner impression on tuber ischii with the biceps(T), tendon of biceps(F)—upper part of internal surface of tibia, under cover of the sartorius(T) (Great sciatic).

Semi-membranosus: upper and outer impression on the tuber ischii(TA)—hinder part of lower lip of groove on internal tibial tuberosity(T) (Great sciatic). *The tendon of insertion splits into three beneath the internal lateral ligament.*

It forms, with the sartorius and gracilis, the inner hamstring.

ANTERIOR TIBIO-FIBULAR REGION.

Tibialis anticus : external tuberosity and upper ⅔ of external surface of shaft of tibia, contiguous interosseous membrane, fascia and intermuscular septum(F)—inner surface of internal cuneiform ; base of metatarsal bone of great toe(T) (Anterior tibial). *Passes through innermost compartment of annular ligament. Outer border conceals anterior tibial vessels.*

Extensor proprius pollicis : middle ⅔ of internal surface of shaft of fibula, contiguous interosseous membrane(F)—base of last phalanx of great toe(T) (Anterior tibial). *Anterior tibial vessels lie on the inner side, but the tendon crosses to outer side under annular ligament.*

Extensor longus digitorum : external tuberosity of tibia, head and upper ¾ of internal surface of shaft of fibula, interosseous membrane(F)—by four tendons into the middle and last phalanges of four outer toes(T).

Peroneus tertius : lower ¼ of internal surface of shaft of fibula, interosseous membrane, intermuscular septum(F)—base of 5th metatarsal on dorsal surface(T) (Anterior tibial).

POSTERIOR TIBIO-FIBULAR REGION, SUPERFICIAL LAYER.

Gastrocnemius : *Inner head.* Impression on upper and posterior part of inner condyle(T), line above condyle(F). *Outer head.* Impression on external surface of outer condyle(T), upper and posterior part of condyle(F)—unites with tendon of soleus to form *tendo Achillis*, inserted into lower half of posterior surface of tuber calcis(T) (Internal popliteal).

Soleus : posterior surface of head and upper ⅓ of shaft of fibula, oblique line and middle ⅓ of posterior edge of tibia(T) —tendo Achillis (Internal popliteal). *Posterior tibial vessels and nerve lie beneath.*

Plantaris : line above outer condyle, posterior ligament of knee-joint(F)—tuber calcis, with or by side of tendo Achillis(T) (Internal popliteal). *Tendon longest in body.*

POSTERIOR TIBIO-FIBULAR REGION, DEEP LAYER.

Popliteus : anterior half of impression on external surface of outer condyle(T), posterior ligament of knee-joint(F)—triangular space on posterior shaft of tibia above oblique line(F) (Internal popliteal). *Forms floor of popliteal space; arises in capsule of joint but outside synovial membrane.*

Flexor longus pollicis : lower ⅔ of posterior shaft of fibula, intermuscular septum(F)—base of last phalanx of great toe(T) (Posterior tibial). *Goes through groove in astragalus.*

Flexor longus digitorum : posterior surface of shaft of tibia from oblique line to 3 in. from lower end, aponeurosis over tibialis posticus(F)—four tendons joined by flexor accessorius passing through slits in tendon of flexor brevis digitorum to bases of last phalanges of four outer toes(T) (Posterior tibial). *Posterior tibial vessels and nerve rest upon it.*

Tibialis posticus : posterior surface of interosseous membrane except below, and aponeurosis superficial to it. External surface of tibia from head to 2 in. from lower end. Upper ⅔ of internal surface of shaft of fibula(F)—tubercle on scaphoid bone, cuneiform cuboid and bases of two, three, four metatarsals(F) (Posterior tibial).

FIBULAR REGION.

Peroneus longus : upper ⅔ external surface of shaft o fibula, fascia, intermuscular septum(F)—internal cuneiform and base of 1st metatarsal(T) (Musculo-cutaneous). *Winds round grooves behind internal malleolus and outer border of cuboid bone.*

Peroneus brevis : lower ⅔ external surface shaft of fibula, intermuscular septum(F)—projection at base of 5th metatarsal(T) (Musculo-cutaneous).

FOOT, DORSAL REGION.

Extensor brevis digitorum : external surface of os calcis in front of groove, annular ligament(F)—four tendons, inner one to base of 1st phalanx of great toe, rest to outer side of tendons of long extensor to 2nd, 3rd, and 4th toes(T) (Anterior tibial).

FOOT, PLANTAR REGION, 1ST LAYER.

Abductor pollicis : inner side of large tubercle on under surface of os calcis, plantar fascia, internal annular ligament(F)—inner side of base of 1st phalanx of great toe(T) (Internal plantar).

Flexor brevis digitorum : inner part of large tubercle of os calcis(T), plantar fascia(F), muscular septa(F)—four tendons to middle phalanges of four outer toes(T) (Internal plantar).

Abductor minimi digiti : outer and fore part of inner tuberosities of os calcis, plantar fascia, intermuscular septa(F) outer side of base of 1st phalanx of little toe (External plantar).

FOOT, PLANTAR REGION, 2ND LAYER.

Flexor accessorius : *Inner head.* Inner concave surface of os calcis(F). *Outer head.* Outer surface of os calcis in front of outer tubercle, ligamentum longum plantæ(F)—long flexor tendons(F) (External plantar).

Lumbricales (4) : long flexor tendon, from two tendons, except most internal one(F)—inner sides of bases of 1st phalanx of four outer toes(T) (Internal plantar, 1st and 2nd, External plantar, 3rd and 4th).

FOOT, PLANTAR REGION, 3RD LAYER.

Flexor brevis pollicis : internal border of cuboid(T), tendon of tibialis posticus(F)—outer side and inner sides of base of 1st phalanx of great toe(T) (Internal plantar).

Adductor pollicis: bases of 2nd, 3rd, and 4th metatarsals, sheath of peroneus longus(F)—outer side of base of 1st phalanx of great toe(T) (External plantar).

Flexor brevis minimi digiti: base of 5th metatarsal, sheath of peroneus longus(F)—outer side of base of 1st phalanx of little toe(T) (External plantar).

Transversalis pedis: capsules of metatarso-phalangeal joints of four outer toes(F)—outer side of base of 1st phalanx of great toe(T) (External plantar).

FOOT, PLANTAR AND DORSAL INTEROSSEOUS REGION.

Interossei dorsales (4): by two heads from adjacent sides of metatarsal bones(F)—side and dorsum of 1st phalanx thus: the inner two go to 2nd toe, one on each side, outer two to outer sides of 3rd and 4th toes respectively(T). (External plantar). *Abduct from middle line of 2nd toe.*

Interossei plantares (3): under and inner surfaces of three outer metatarsal bones(F)—inner side of base of 1st phalanx of same toes(T), and common extensor tendon on dorsum(T) (External plantar). *Adduct to middle line of 2nd toe.*

ACTION OF MUSCLES.

Head is moved *Forwards* by platysma myoides, sterno-mastoid, rectus capitis anticus major, rectus capitis anticus minor, (assisted by, when jaw is fixed) mylo-hyoid, genio-hyoid, genio-hyoglossus, digastricus. *Backwards* by trapezius, splenius capitis, complexus, trachelo-mastoid, rect. cap. post. maj., rect. cap. post. min., obliquus cap. superior. *Sideways* by platysma myoides, sterno-cleido-mastoid, trapezius, splenius capitis, splen. colli, trachelo-mastoid, complexus.

Neck: *Forwards* by platysma myoides, sterno-cleido-mastoid, digastricus, mylo-hyoid, genio-hyoid, genio-hyoglossus, omo-hyoid, sterno-hyoid, thyro-hyoid, rect. cap.

ant. major and minor, longus colli. *Backwards* by trapezius, rhomboideus minor, serratus posticus superior, splenius capitis, splenius colli, complexus, trachelo-mastoid, transversalis colli, inter-spinales colli, rect. cap. post. maj. and minor, obliquus capitis superior and inferior, scalenus posticus, levator anuli scapulae. *Sideways* by the above in conjoined action, and the scaleni, inter-transversales, recti-laterales.

Trunk: *Forwards* by rectus abdominis, pyramidalis, obliquus externus and internus abdominis, psoas magnus and parvus; assisted by (when arms are carried forwards) pectoralis major and minor, serratus magnus. *Backwards* trapezius, rhomboideus major, latissimus dorsi, serratus posticus superior and inferior, sacro-lumbalis, longissimus dorsi, spinales dorsi, semi-spinalis dorsi, multifidus spinæ, intertransversalis dorsi et lumborum. *Laterally*, obliquus externus and internus, quadratus lumborum, longissimus dorsi, sacrolumbalis, serratus posticus, latissimus dorsi.

Scapula: *Forwards* by pectoralis minor, serratus magnus. *Backwards*, trapezius, rhomboidei, latissimus dorsi. *Upwards*, trapezius, levator scapulæ, rhomboidei. *Downwards*, trapezius, latissimus dorsi, pectoralis minor.

Humerus: *Forwards*, deltoid, pectoralis major; assisted sometimes by biceps, coraco-brachialis. *Backwards*, deltoid, teres major and minor, triceps (long head), latissimus dorsi. *Inwards*, pectoralis major, latissimus dorsi. *Rotated inwards*, subscapularis, assisted by pectoralis major, lat. dorsi, teres major. *R. outwards*, supra-spinatus, infra-spinatus, teres minor.

Forearm: *Forwards*, biceps, brachialis anticus, pronator radii teres; assisted by flex carpi rad., flex sublimis digitorum, flex carpi ulnaris, supinator longus. *Backwards*, triceps, anconeus. *Rotated inwards*, pronator radii teres, flex. carpi radialis, palmaris longus, flexor sublimis dig., pronator quadratus. *R. outwards*, biceps, supinator brevis, extensor, secundi internodii pollicis.

Carpus: *Forwards*, flex carpi radialis, palmaris longus, flex. sublimis and profundis dig., flex carpi ulnaris, flex. longus pollicis. *Backwards*, ext. carpi rad. long. and brev., ext. secundi internodii policis, ext. indicis, ext. com. dig., ext. prop. pollicis. *Outwards*, flex carpi rad., ext. carp. rad. long. and brevior, ext. ossis metacarpi pol., ext. primi internodii pol. *Inwards*, flex. sublim. and profund. digitorum, flex. and ext. carpi ulnaris, ext. com. dig., ext. min., digiti.

Thumb: *Inwards* and *forwards*, opponens, flex. brevis and flex. long. pollicis. *Outwards* and *backwards*, ext. ossis metacarpi, ext. primi and secundi internodii pollicis. *Upwards* and *away from fingers*, abductor, flex. brev. pollicis. *Backwards* and *towards fingers*, adductor, ext. primi and secundi internodii pollicis.

Fingers: *Flexed*, flex. sublimis and profundus dig., lumbricales, flex. and abductor minimi digiti. *Backwards*, ext. communis, ext. minimi digiti and indicis. *Outwards*, interossei, abductor indicis and minimi digiti. *Inwards*, interossei, abductor minimi digiti.

Thigh: *Forwards*, psoas mag., iliacus, tensor vaginæ fem. pectineus, adductor longus and brevis. *Backwards*, glut. max. and med., pyriformis, obturator intern., add. mag., biceps, semitend., semi-membranosus. *Inwards*, psoas mag., iliacus, pectineus, gracilis, the 3 adductores, obturator extern., quad. femoris. *Outwards*, tens. vag. fem., the 3 glutæi, pyriformis. *Rotated inwards*, tens. vag. fem., glut. med., and, if leg extended, sartorius, semi-tendinosus. *R. outwards*, glut. max. and med., pyriformis, gemelli, obturatores, quad. fem., psoas mag., iliacus, the 3 adductores, biceps femoris.

Leg: *Flexed*, semi-tendinosus, biceps, semi-membranosus, gracilis, sartorius, popliteus. *Extended*, rectus fem., crureus 2 vasti.

Foot: *Inwards*, ext. prop. pollicis, flex. long. dig., flex. long. pol., tibialis posticus. *Outwards*, the 3 peronei, ext. long. dig. *Flexed*, tibialis anticus, ext. prop. pol., ext. long. dig., peroneus tertius. *Extended*, gastrocnemius, plantaris, soleus, flex. long. dig., flex. long. pol., tib. posticus, peroneus longus and brevis.

Toes: *Flexed*, adductor, abductor, flex. longus and brevis pollicis, abductor and flex. brev. minimi digiti, flex. brev. and longus digitorum, flex. accessorius, lumbricales, interossei. *Extended*, ext. long. and brevis digitorum, ext. prop. pollicis. *Inwards*, abductor pollicis, interossei. *Outwards*, add. pollicis and min. digiti, interossei.

THE ARTERIES.

ARTERIES OF HEAD AND NECK.

SUBCLAVIAN.—*Extent: Right*, from innominate opposite right sterno-clavicular articulation. *Left*, from transverse part of arch of aorta. Both pass into neck, arching outwards over pleura; lying on first rib between scalenus anticus and medius, to end at outer border of it.

Divisions: The scalenus anticus, passing anteriorly to artery; it is used to divide it into three parts, viz.:

1st part, from origin of vessel to inner border of scalenus anticus.

2nd part, portion posterior to scalenus anticus.

3rd part, from outer edge of scalenus to external border of 1st rib.

RELATIONS OF THE 1ST PART OF THE RIGHT SUBCLAVIAN.

In Front.				*Below.*		*Behind.*	
Deep cervical fascia.		Internal jugular Anterior jugular Vertebral	Veins.	Pleura.		Longus colli muscle.	
Platysma Sterno-mastoid Sterno-hyoid Sterno-thyroid	Muscles.	Pneumogastric, with lower cardiac branch, Descendens noni	Nerves.	Subclavian Innominate	Veins.	Recurrent laryngeal Cardiac branches of sympathetic	Nerves.
				Recurrent laryngeal nerve			

RELATIONS OF 1ST PART OF LEFT SUBCLAVIAN.

In Front.		*Inner Side.*	*Behind.*
Left lung. Pleura. Deep fascia. Platysma	Veins. Internal jugular Left innominate	Left carotid. Trachea. Œsophagus. Thoracic duct. Lower cardiac branches of sympathetic.	Longus colli. Œsophagus. Thoracic duct. Inferior cervical ganglion.
Muscles. Sterno-mastoid Sterno-hyoid Sterno-thyroid	Nerves. Pneumogastric Phrenic		

RELATIONS OF 2ND PART OF SUBCLAVIAN.

In Front.		*Behind.*	*Below.*
Deep fascia. Platysma	Sub-clavian vein (below level). Phrenic nerve.	Middle scalenus. Trunk of last cervical and 1st dorsal nerves.	Pleura.
Muscles. Sterno-mastoid (sternal origin) Scalenus anticus			*Above.* Brachial plexus.

RELATIONS OF 3RD PART OF SUBCLAVIAN.

Contained in subclavian triangle, and enclosed in tube of deep cervical fascia.

In Front.		*Below.*
Deep fascia. Platysma.	Supra-scapular vessels. Clavicle. Subclavius.	1st rib.
Veins. External jugular Sub-clavian	*Above.* Brachial plexus.	*Behind.* Scalenus medius.

BRANCHES FROM THE 1ST PART.

VERTEBRAL: from upper and back part, enters vertebral foramen of 6th cervical vertebra: ascending the foramina it reaches upper border of atlas; it then courses backwards and inwards, piercing occipito-atlantal ligament, and dura mater, enters skull through foramen magnum, then upwards and forwards to front of medulla, uniting with opposite artery to form basilar, at the lower border of the pons.

Cervical Branches.

Spinal: each enters spinal canal through an intervertebral foramen, dividing into anterior to supply cord and membranes and posterior to supply bodies of vertebræ.

Muscular: to deep cervical muscles.

Cranial Branches.

Posterior meningeal: (2) arise opposite foramen magnum, to falx cerebelli.

Posterior spinal arises opposite posterior part of medulla, passes down back of cord behind roots of nerves, anastomising with spinal branches coming through intervertebral foramina.

Anterior spinal: given off near end of artery, descends in front of medulla, unites with opposite fellow just below foramen magnum, descends along the cord, anastomising like the posterior artery; supplies pia mater and cord.

Posterior inferior cerebellar: arises near pons, backwards and outwards between hypoglossal and pneumogastric nerves, to reach under surface of cerebellum, divides into two branches, one continuing back in sulcus between two hemispheres, the other outwards to supply under surface of cerebellum, and *anas.* superior cerebellar. Supplies hemisphere, vermiform process, and choroid plexus of 4th ventricle.

THYROID AXIS: a short thick trunk from front of artery near scalenus anticus, quickly dividing into:

Inferior thyroid: passes upwards on longus colli; then inwards and downwards behind sheath of carotid and sympathetic, finally outwards and upwards to under part of thyroid body; *anas.* opposite fellow superior thyroid.

Branches.

Ascending cervical: arises as artery turns behind sheath, ascends parallel to phrenic nerve and between scalenus anticus and rectus anticus major, supplying then the cord and its membranes.

Laryngeal: upwards on trachea to back of larynx.

Tracheal: to trachea; *anas.* bronchial.

Œsophageal: to supply œsophagus.

Supra-scapular: runs downwards at first, over scalenus anticus, then crosses 3rd part of subclavian, then transversely outwards behind and parallel to clavicle, to upper edge of scapula under cover of trapezius, inclining downwards with nerve to pass over supra-scapular notch, and enter supra-spinous fossa in contact with the bone beneath supra-spinatus.

Branches.

Muscular: to neighbouring muscles.

Supra-acromial: through trapezius to acromion; *anas.* acromial thoracic.

Subscapular: arises as artery passes over notch; *anas.* in subscapular fossa with posterior scapular and subscapular.

Infra-spinatis: descends between glenoid cavity and spine; *anas.* dorsal subscapular.

Articular: to shoulder joint. *Nutrient:* to scapular.

Transverse cervical: over scaleni muscles and brachial plexus to outer edge of levator anguli scapulæ.

Branches.

Superficial cervical: ascends beneath anterior edge of trapezius supplying it, together with glands and integuments of that region.

Posterior scapular: backwards to superior angle of scapula beneath levator anguli, then downwards on vertebral border of scapula; *anas.* supra-scapular, sub-scapular, supplying surrounding muscles.

Internal mammary: from under surface of subclavian just below thyroid axis, runs down behind clavicle to posterior surface of 1st costal cartilage, forwards between pleura and cartilages as far as the 6th, there dividing into two terminal branches.

Branches.

Comes nervi phrenici (*superior phrenic*): arises high in chest, accompanies phrenic nerve, between pleura and pericardium to diaphragm, supplying it; *anas.* musculo-phrenic, inferior phrenic.

Mediastinal: to areolar tissue of anterior mediastinal and thymus gland.

Pericardiac: to upper part of pericardium.

Sternal: to triangularis sterni and sternum.

Anterior intercostal: to upper five or six intercostal spaces, two in each space; *inosculate* with aortic intercostal.

Perforating: perforate upper five or six intercostal spaces to supply pectoral muscles and mammary gland.

Musculo-phrenic: external of two terminal branches perforates diaphragm about 9th intercostal space, supplying diaphragm, and branches to lower intercostal spaces.

Superior epigastric: internal terminal branch, lies posterior to rectus in the sheath terminating in that muscle; *anas.* inferior epigastric of external iliac.

BRANCH FROM THE 2ND PART.

SUPERIOR INTERCOSTAL: from upper and back part behind scalenus anticus, bends backwards in front of neck of 1st rib to 1st and 2nd intercostal spaces, supplies small branches to cord and deep spinal muscles.

Branch.

Deep cervical: corresponds to posterior branch of an aortic intercostal, passes between transverse process of 7th cervical vertebra and 1st rib, ascending beneath complexus to axis; *anas.* vertebral, cervical of occipital.

COMMON CAROTID: *On the right side*, arises from the innominate at its bifurcation, behind the right sterno-clavicular articulation. *On the left side*, from the highest or transverse part of aortic arch, and is consequently longer than the right artery, and more deeply placed in the thorax at its origin. It ascends obliquely to the neck.

Connections of the Left Common Carotid in the Thorax.

In Front.	*Behind.*	*Inner Side.*
1st piece of sternum.	Trachea.	Innominate artery.
Sterno-hyoid and	Œsophagus.	
Sterno-thyroid muscles.	Thoracic duct.	*Outer Side.*
Left innominate vein.		Left subclavian artery.
Thymus gland.		Pneumogastric nerve.

Extent.—In the neck the common carotid of either side extends from sterno-clavicular articulation to opposite upper border of thyroid cartilage, there dividing into external and internal carotids.

Course.—A line drawn from sterno-clavicular articulation to point midway between mastoid process and angle of inferior maxilla.

Connections.—Crossed about midway by omo-hyoid.

Part below Superior Border of Omo-hyoid.

In Front.				*Behind.*	*Inner Side.*
Platysma.		Internal jugular (on left side)	Veins.	Longus colli.	Trachea.
Deep fascia.		Middle thyroid		Inferior thyroid artery	Œsophagus.
Sterno-mastoid (sternal origin)	Muscles.	Inferior thyroid artery.		Sympathetic.	Thyroid body.
Sterno-hyoid		Descendens noni.		Recurrent laryngeal.	
Sterno-thyroid				*Outer Side.*	
Omo-hyoid				Internal jugular.	
				Pneumogastric.	

Part above Omo-hyoid.

In Front.	*Behind.*	*Inner Side.*
Platysma.	Rectus capitis anticus.	Larynx.
Deep fascia.	Pneumogastric nerves.	Pharynx.
Sterno-mastoid.	Sympathetic ,,	
Upper thyroid vessels.		*Outer Side.*
Descendens noni.		Internal jugular.

EXTERNAL CAROTID.—*Extent:* from bifurcation of common carotid opposite upper border of thyroid cartilages, to neck of condyle of inferior maxilla, there dividing into temporal and internal maxillary.

Course.—Line of artery same as common carotid.

CONNECTIONS.

Superficial.				*Behind.*		*Inner Side.*
Platysma.		Facial	Veins.	Pharynx.		Pharynx.
Deep fascia.		Lingual		Stylo-pharyngeus.		Ramus of jaw.
Sterno-mastoid	Muscles.	External jugular		External laryngeal	Nerves.	Stylo-maxillary ligament.
Digastric		Hypoglossal	Nerves.	Superior laryngeal		Parotid gland.
Stylo-hyoid		Facial		Glosso-laryngeal		
Parotid gland.				Parotid gland.		

Anterior Branches.

Superior thyroid: given off just below great cornu of hyoid, curves downwards and forwards to thyroid body; *anas.* fellow of opposite side, inferior thyroid.

Branches.

Muscular: to muscles covering it.

Hyoid: runs transversely inwards, along inferior border of hyoid; *anas.* with opposite fellow.

Superficial: descending downwards and outwards across sheath of common carotid, supplying adjacent muscles and integument.

Superior laryngeal: accompanied by superior laryngeal nerve, pierces thyro-hyoid membrane, supplies muscles, glands, and mucous membrane of larynx; *anas.* opposite fellow.

Crico-thyroid: crosses crico-thyroid membrane transversely; *anas.* opposite fellow.

Lingual: arises from anterior part of artery between superior thyroid and facial arteries, curves upwards and inwards to tip of great cornu of hyoid, thence forwards under hyoglossus muscle, parallel with hypoglossal nerve, finally continued to tip of tongue as ranine.

Hyoid: along superior border of hyoid, supplying muscle, &c.; *anas.* opposite fellow.

Dorsal of tongue: ascends to dorsum of tongue; *anas.* opposite fellow, supplies mucous membrane, tonsil, epiglottis, soft palate, &c.

Sublingual: runs forwards and outwards to supply sublingual gland, adjacent muscles and mucous membrane.

Ranine: continuation of the lingual to tip of tongue, accompanies gustatory nerve; *anas.* opposite fellow.

Facial: arises near angle of inferior maxilla, directed forwards and upwards beneath digastric and stylo-hyoid muscles and over submaxillary gland to base of lower jaw, over which it ascends to face, anterior to masseter muscle, ascending to inner canthus, resting successively upon lower jaw, buccinator, levator anguli oris, with vein to outer side; *anas.* ophthalmic.

Cervical Branches.

Ascending palatine: between stylo-glossus and stylo-pharyngeus to pharynx near border of internal pterygoid muscle; after supplying muscles, tonsil, Eustachian tube, divides near levator palati into two branches, one going to supply soft palate glands, &c., the other to tonsil, and *anas.* tonsillar.

Tonsillar: penetrates superior constrictor of pharynx to supply tonsil and root of tongue; *anas.* ascending palatine.

Submaxillary (three or four) to supply submaxillary gland.

Submental: arises as artery turns round base of jaw, forwards over myo-hyoid, supplying it and digastric to symphysis; there dividing into superficial, which turns round chin; *anas.* inferior labial, deep branch runs on bone, supplying deep muscles, *anas.* inferior labial.

Facial Branches.

Muscular: to masseter, buccinator, &c.

Inferior labial: runs beneath depressor anguli oris, to supply lower lip; *anas.* inferior coronary, submental, inferior dental.

Inferior coronary: arises near angle of mouth, tortuous course between mucous membrane of lower lip and orbicularis oris; inosculates with opposite fellow.

Superior coronary: arises with or near preceding, having same course only in upper lip; inosculates with opposite fellow, supplies a branch, *artery of septum,* to nose.

Lateral nasal: turns inwards beneath levator labii superioris alæque nasi to supply ala and dorsum of nose; *anas.* opposite fellow, nasal of ophthalmic, infra-orbital.

Angular: terminal branch; inosculates at inner canthus with nasal of ophthalmic.

Posterior Branches.

Occipital: arises from the posterior part of artery, about opposite the facial, upwards and backwards beneath digastric to interval between atlas transverse process and mastoid process, then backwards in the occipital groove; lastly, piercing the trapezius near insertion, it ascends in company with the great auricular nerve to the back of cranium.

Branches.

Muscular to digastric stylo-hyoid; *sterno-mastoid* branch to supply that muscle.

Auricular: to back of concha.

Inferior meningeal: ascends, in company with internal jugular vein, through jugular foramen to dura mater in posterior fossa.

Cervical (*ramus cervicalis princeps*), descends back of neck; superficial branch passes beneath splenius, supplying it and the trapezius; *anas.* superficial cervical, deep branch, goes beneath complexus, *anas.* vertebral, deep cervical.

Cranial: to muscles and teguments of occiput.

Posterior auricular: arises opposite apex of styloid process, ascends in parotid to groove between pinna and mastoid process, dividing into anterior, *anas.* posterior division of temporal, and posterior, *anas.* occipital, crossed near mastoid process by portio dura of the 7th nerve.

Branches.

Stylo-mastoid: enters stylo-mastoid foramen, supplying tympanum, mastoid cells, &c.

Auricular: to posterior part of concha.

Ascending Branch.

Ascending pharyngeal: smallest branch arises half an inch above origin of trunk, ascends on rectus capitis anticus major to base of skull.

Branches.

External: to rectus anticus, 1st cervical ganglion, 8th and 9th nerves, glands, &c.

Pharyngeal (three or four): inwards to pharynx, supplying Constrictor's, Eustachian tube, and a *palatine* branch to soft palate.

Meningeal: one through foramen jugulare, another through anterior condyloid foramen, and a third through foramen lacerum to supply dura mater.

Terminal Branches.

Temporal: smaller of two terminal branches, continues in the line of external carotid. Imbedded at first in parotid, crosses then over root of zygoma upwards under skin for two inches, dividing into two terminal branches.

Branches.

Transverse facial: arises in parotid, accompanies branches of facial and auriculo-temporal nerve across face, supplying muscles, glands, &c.; *anas.* facial, infra-orbital.

Middle temporal: arises just above zygoma, perforates temporal fascia, supplying muscle; *anas.* deep temporal; gives also an offset to outer canthus.

Anterior auricular: to anterior portion of external ear.

Anterior temporal: one of terminal branches, ascends over temporal fascia, supplying muscles, &c.; *anas.* frontal, supra-orbital.

Posterior temporal: curves backwards over temporal fascia and inosculates with opposite fellow; *anas.* posterior auricular, occipital.

Internal maxillary: larger of terminal branches, arises in parotid at first (maxillary portion), curving forwards between jaw and internal lateral ligament, parallel with auriculo-temporal nerve, then (pterygoid portion) forwards and outwards of outer surface of external pterygoid, finally (spheno-maxillary portion) enters spheno-maxillary fossa between two origins of external pterygoid.

Branches from Maxillary Portion.

Tympanic: enters Glaserian fissure to supply laxator tympani; *anas.* vidian, stylo-mastoid.

Middle meningeal: arises between internal lateral ligament and neck of condyle through foramen spinosum of the sphenoid, dividing into anterior and posterior branches, anterior going to anterior inferior angle of parietal, posterior to squamous of temporal; *anas.* opposite fellow, anterior and posterior meningeal.

Small meningeal: through foramen ovale, supplies Gasserian ganglion; before entering skull supplies nasal fossa and soft palate.

Inferior dental: descends with inferior dental nerve through dental foramen on inner side of ramus of inferior maxilla, divides opposite 1st bicuspid into incisor and mental, the former going to incisor teeth; *anas.* opposite fellow, the latter comes out mental foramen; *anas.* sub-mental, inferior labial, inferior coronary. *Mylo-hyoid branch* given off to run in mylo-hyoid groove as artery enters dental foramen.

Branches from Pterygoid Portion.

Deep temporal: (2): anterior and posterior to temporal fossa between muscle and cranium; *anas.* other temporal, lachrymal through foramina in malar bone.

Pterygoid: to pterygoid muscles.

Masseteric: passes over sigmoid notch to deep surface of masseter.

Buccal: runs forward with buccal nerve to buccinator.

Branches of Spheno-Maxillary Portion:

Superior dental: given off as artery, passes into spheno-maxillary fossa; descends with branch of superior maxillary nerve, entering foramina in bone, supplying molars, bicuspids, gums, &c.

Infra-orbital: continuation of trunk, accompanies superior maxillary nerve through infra-orbital foramen, appearing in face beneath levator labii superioris; *anas.* facial and buccal. In the canal it gives off branches to orbit, and an *anterior dental* branch goes with nerve to supply front teeth; *anas.* posterior dental.

Descending palatine: through posterior palatine canal along hard palate through incisor foramen; *anas.* artery of septum.

Vidian: through vidian canal with nerve, supplies Eustachian tube and tympanum.

Pterygo-palatine: backwards through pterygo-palatine canal with pharyngeal nerve to upper part of pharynx.

Naso-palatine: enters spheno-palatine foramen, supplying posterior ethmoidal cells, &c.

INTERNAL CAROTID: *Extent.* From superior border of thyroid cartilage to Sylvian fissure of brain, there dividing into anterior and middle cerebral.

Course. Extends directly upwards from common carotid to carotid canal of temporal bone, entering cranium, goes along base of skull to anterior clinoid processes. No branches given off from cervical part.

CONNECTIONS IN THE NECK.

In Front.	*Outer Side.*	*Behind.*
Deep fascia.	Internal jugular vein.	Rectus capitis anticus.
Parotid gland.	Vagus nerve.	
Stylo-glossus muscle.		Sympathetic.
Stylo-pharyngeus muscle.	*Inner Side.*	Superior.
Glosso-pharyngeal nerve.	Pharynx.	Laryngeal nerve.
	Ascending pharyngeal artery.	

Branch from Petrous portion.

Tympanic: through a foramen in carotid canal to tympanum.

Branches from Cavernous portion.

Receptaculæ arteriæ: small branches to pituitary body, &c.

Ophthalmic: arises at inner side of clinoid process, enters orbit through optic foramen, external to 2nd nerve; it then crosses to inner angle to divide into two terminal branches, frontal and nasal.

Branches arising outside Optic Nerve.

Lachrymal: accompanies lachrymal nerve over external rectus to lachrymal gland, malar branches to *anas.* deep temporal and transverse facial. Branch sent back to *anas.* middle meningeal.

Central of retina: pierces optic nerve, runs in its substance to retina.

Branches arising over Optic Nerve.

Posterior ciliary (12): perforate posterior part of sclerotic; two of them are called *long* ciliary, from their piercing the eyeball further forwards than rest.

Supra-orbital: ascends with frontal nerve over muscles, &c., to supra-orbital foramen; passing out, ascends frontal bone; *anas.* temporal, facial.

Branches arising internal to Optic Nerve.

Muscular (2) to muscles of orbit, give off *anterior* ciliary arteries, which pierce sclerotic anterior to posterior ciliary.

Ethmoidal: anterior and posterior to ethmoidal cells, supplying also dura mater, the anterior accompanying nasal nerve.

Palpebral (2) : one for each lid, arise near pulley, form an arch in each lid, and supply lachrymal apparatus.

Terminal Branches.

Frontal: turns upwards round inner margin of orbit; *anas.* supra-orbital.

Nasal: over tendo oculi to root of nose; *anas.* nasal and angular of facial.

Branches from Cerebral Portion.

Anterior cerebral : arises at inner extremity of fissure of Sylvius, passes forwards in great longitudinal fissure opposite arteries, united with anterior communicating. It then curves round fore-part of corpus callosum, supplying off-sets to posterior extremity of hemisphere.

Middle cerebral : largest off-set, enters fissure of Sylvius, dividing into branches for external surface of hemisphere, *inosculate* anterior and posterior cerebral.

Posterior communicating : from posterior part of artery runs backwards; *anas.* posterior cerebral of basilar.

Anterior choroid : from back part of artery, passes backwards and outwards to enter descending horn of lateral ventricle, just beneath edge of middle lobe; supplies hippocampus major, corpus fimbriatum, and choroid plexus.

BASILAR : formed by union of two vertebral arteries. *Extent*, from lower to upper border of pons, there splitting into posterior cerebral.

Branches.

Transverse (4 or 6) : twigs to supply pons, and an offset to internal ear, with auditory nerve.

Superior cerebellar : arises near termination, to cerebellum, over 3rd nerve, and crus cerebri; *anas.* opposite fellow, inferior cerebellar.

Posterior cerebral (2) : terminal of basilar, wind round crus cerebri to under surface of posterior cerebral lobes; *anas.* anterior and middle cerebral.

CIRCLE OF WILLIS: a name given to inosculations between vertebral and internal carotid arteries at base of brain. The internal carotid sends forward the anterior cerebrals, which are connected by the anterior communicating. The basilar sends forwards the posterior vertebrals, which are joined to the carotid by the posterior communicating.

ARTERIES OF UPPER LIMBS.

THE AXILLARY ARTERY.

Extent.—From lower border of 1st rib to tendons of latissimus dorsi and teres major, divided into three parts.

1ST PART. *Extent.*—1st rib to upper border of pectoralis minor.
Relations.—*In front.* Pectoralis major, costo-coracoid membrane, subclavius, cephalic vein.
Behind. 1st intercostal space and muscle, 1st serration of serratus magnus, posterior thoracic nerve.
Inner side. Axillary vein. *Outer side.* Brachial plexus.

2ND PART. *Extent.*—From superior to inferior border of pectoralis minor.
Relations.—*In front.* Pectorales major and minor.
Behind. Subscapularis, posterior cord of plexus.
Inner side. Outer cord of plexus.
Outer side. Vein, inner cord of plexus.

3RD PART. *Extent.*—From inferior border of pectoralis minor to tendon of latissimus dorsi.
Relations.—*In front.* Pectoralis major.
Behind. Subscapularis, tendons of latissimus dorsi and teres major, musculo-spiral and circumflex nerves.
Inner side. Vein, ulnar and internal cutaneous nerves and nerve of Wrisberg.

Outer side. Coraco-brachialis, median and musculo-cutaneous nerves.

Branches.

Superior thoracic (1st part): arises opposite 1st intercostal space, supplies pectorales; *anas.* internal mammary, intercostals.

Acromial thoracic (1st part): arises from front of artery just above pectoralis minor.

Branches.

Acromial: supply deltoid, sends one branch with cephalic vein and inferior acromial to perforate deltoid; *anas.* branch of supra-scapular.

Thoracic: two or three branches to supply side of thorax; *anas.* intercostal.

Ascending: one or two twigs to deltoid and subclavius.

Long thoracic (2nd part): passes downwards along inferior border of pectoralis minor to about 6th intercostal space, supplies pectorales and serratus magnus; *anas.* intercostal and other thoracic. *In females* gives branches to mammary gland.

Alar thoracic (2nd part): supplies glands and fat of the axillary space; not a constant separate branch.

Subscapularis (3rd part): arises opposite lower border of subscapularis muscle, and courses with subscapular nerve to lower angle of scapula.

Branch.

Dorsal: given off near origin to dorsum of scapula, which divides into infra-scapular off-sets. Supplies scapular, latissimus dorsi, teres major, serratus magnus; *anas.* with each other.

Anterior circumflex (3rd part): arises for outer side of artery, ascends bicipital groove to head of humerus; *anas.* posterior circumflex.

Posterior circumflex (3rd part): arises from back of artery opposite lower border of subscapularis, winds backwards through quadrilateral space, and supplies deltoid, head of humerus, shoulder joint, teres minor, and long head of triceps; *anas.* acromial thoracic, anterior circumflex.

External mammary: commonly met with in females, supplies axillary and mammary glands.

THE BRACHIAL ARTERY.

Extent.—From lower border of teres major to half inch below bend of elbow, runs along inner borders of coraco-brachialis and biceps.

Relations.—In front. Integument, fascia, bicipital fascia, median basilic vein, crossed by median nerve at insertion of coraco-brachialis.

Behind. Long and inner heads of triceps, musculo-spiral nerve, superior profunda vessels, coraco-brachialis, brachialis anticus.

Inner side. Internal cutaneous nerve to about middle of arm, ulnar nerve to insertion of coraco-brachialis, median nerve from insertion of coraco-brachialis to elbow.

Outer side. Median nerve from origin of artery of insertion of coraco-brachialis.

Branches.

Superior profunda: arises opposite lower border of teres major, winds backwards with musculo-spiral nerve in the groove to triceps; *anas.* recurrent radial, posterior interosseous recurrent, inferior profunda, anastomotic. Supplies triceps, anconeus.

Nutritious: arises about middle of humerus, and enters medullary foramen near insertion of coraco-brachialis.

Inferior profunda: arises opposite insertion of coraco-brachialis, accompanies ulnar nerve; *anas.* posterior ulnar recurrent and anastomotic at elbow.

Anastomotica: arises two in. above elbow-joint, courses to hollow between olecranon and inner condyle of humerus; *anas.* inferior profunda, posterior.

Muscular: to coraco-brachialis, biceps, brachialis anticus.

THE RADIAL ARTERY.

Extent.—From bifurcation of the brachial to deep palmar arch of hand.

Relations in the forearm.—In front. Integument, fascia, supinator longus.

Behind. Tendon of biceps, supinator brevis, pronator radii teres, flexores longus pollicis et sublimis digitorum, pronator quadratus, radius.

Inner side. Pronator radii teres, flexor carpi radialis.

Outer side. Supinator longus, middle 3rd by radial nerve.

The artery courses along inner border of supinator longus to carpus, winds round carpus beneath extensors of thumb, enters palm of hand between thumb and index finger, forming deep palmar arch.

Branches.

Radial recurrent: arises just below elbow, ascends to between brachialis anticus and supinator longus, supplying them and the elbow-joint; *anas.* superior profunda.

Muscular: to muscles attached to radial side of forearm.

Superficial volar: arises when the artery is about to wind round carpus, passes between muscles of ball of thumb; *anas.* with ulnar and completing superficial palmar arch.

Anterior carpal: arises near lower border of pronator quadratus; *anas.* anterior carpal of ulnar.

Posterior carpal: arises beneath extensor tendons of thumb; *anas.* posterior carpal of ulnar, anterior interosseous artery, posterior perforating of deep arch, forming 3rd and 4th dorsal interosseous.

Metacarpal (1st dorsal interosseous): arises near or with the posterior carpal; *anas.* perforating interosseous of deep arch, digital of superficial arch; supplies adjoining sides of index and middle fingers.

Dorsal of thumb (2): arise near base of 1st metacarpal, course along sides of dorsum of thumb.

Dorsal of index finger: courses along radial side of dorsum of index, supplying abductor indicis.

Princeps pollicis: arises as the artery enters palm, courses between abductor indicis and abductor pollicis, along inner side of 1st metacarpal to base of 1st phalanx, where it divides into two terminal branches, which run along the sides of the palmar surface of thumb.

Radialis indicis: arises near the preceding, runs along outer side of index finger; *anas.* digital of superficial arch.

Deep arch: extent, from 1st interosseous space to base of 5th metacarpal.

Branches.

Recurrent: to front of carpus; *anas.* carpal arteries.

Palmar interossei (3): in the three inner interosseous spaces join digital of superficial arch at cleft of fingers.

Perforating: pierce three inner dorsal interossei; *anas.* dorsal interosseous.

THE ULNAR ARTERY.

Extent.—From bifurcation of brachial to end in superficial palmar arch, courses along outer side of flexor carpi ulnaris to the palm.

Relations in the forearm.—In front. Superficial flexor muscles and median nerve in upper half; lower half, superficial.

Behind. Brachialis anticus, flexor profundus digitorum.

Inner side. Flexor carpi ulnaris, in the lower ⅔ the ulnar nerve.

Outer side. Flexor sublimis digitorum.

Lies upon annular ligament at wrist, internal to the pisiform bone.

Branches.

Anterior ulnar recurrent: arises near bifurcation of brachial, ascends beneath brachialis anticus and pronator radii teres, supplying them; *anas.* inferior profunda, anastomotic.

Posterior ulnar recurrent: arises below the anterior, passes beneath flexor sublimis, ascends behind inner condyle, thence between heads of flexor carpi ulnaris, supplying joint and muscles around; *anas.* inferior profunda, anastomotic, recurrent of interosseous.

Interosseous: about one inch long, arising just below radial tubercle, passing to interosseous membrane, dividing into two terminal branches.

Branches.

Anterior interosseous:- passes down forearm, resting upon anterior surface of interosseous membrane, accompanied by interosseous branch of median, at upper border of pronator quadratus; one branch goes in front to *anas.* with anterior carpal and deep arch, the other descends behind muscle, piercing interosseous membrane, goes to back of carpus; *anas.* posterior interosseous, posterior carpal of radial and ulnar; supplies *nutrient* branches to radius and ulna and branch to median nerve.

Posterior interosseus: passes backwards between oblique ligament and interosseous membrane, runs down back of forearm between superficial and deep muscular layers; *anas.* posterior carpal of radial and ulnar, anterior interosseous.

Posterior interosseous recurrent: given off near origin, goes through interval between ulnar and external condyle, beneath anconeus and supinator brevis; *anas.* superior profunda, posterior ulnar recurrent, anastomotic.

Muscular: to muscles on ulnar side of forearm.

Anterior carpal: courses beneath tendons of flexor profundus; *anas.* anterior carpal of radial.

Posterior carpal: arises just above pisiform, winds back beneath flexor carpi ulnaris tendon, gives branch to *anas.* with posterior carpal of radial, forming *posterior carpal arch*, the artery being continued to form dorsal branch of 5th metacarpus.

Superficial palmar arch: gives off four *digital* branches to supply three inner fingers and one side of index finger; *anas.* communicating of deep arch. The *profunda* or communicating branch is given off at commencement of arch, passes down with a branch of ulnar nerve to deep arch.

ARTERIES OF BODY.

THE AORTA.

Large main trunk of systemic arteries, situated partly in thorax and partly in abdomen, commences at left ventricle, arches over root of left lung, descends in front of vertebral column, through diaphragm into abdomen, ending opposite body of 4th lumbar vertebra by bifurcating into two common iliacs. Conveniently divided into three parts: *arch of aorta, thoracic aorta, abdominal aorta.*

Arch of Aorta: divided, according to the direction, into ascending, transverse, and descending portions. In the concavity of the arch are contained root of left lung, branching of pulmonary artery with ductus arteriosus, left recurrent laryngeal nerve, œsophagus and thoracic duct.

Ascending part: *Extent and Course.* From base of left ventricle, passing behind pulmonary artery, goes upwards and to the right, crossing the posterior surface of the sternum obliquely, extending as high as superior border of and right costal cartilage, two inches in length.

Relations.—Is contained nearly completely in pericardium.

In Front.	*Behind.*	*Right Side.*	*Left Side.*
Pulmonary artery. Right auricular appendix. Thymus gland.	Right pulmonary vessels. Root of right lung.	Superior cava. Right auricle.	Pulmonary artery.

Branches.—Right and left coronary arteries distributed to heart (*vide* Heart).

Transverse part: commences at upper border of 2nd right costal cartilage, arching backwards over root of left lung, as far as inferior border of side of body of 4th dorsal vertebra.

Relations.

In Front.	*Above.*	*Below.*	*Behind.*
Left vagus Left phrenic Cardiac } Nerves Left pleura and lung.	Left innominate vein. Upper intercostal vein. Left carotid arteries. Left subclavian arteries.	Bifurcation of pulmonary artery. Ductus arteriosus. Left bronchus.	Trachea. Deep cardiac plexus. Œsophagus. Thoracic duct.

Left vagus nerve gives off recurrent laryngeal, which winds back beneath vessel.

Branches.

Innominate (1½ to 2 inches long): arises at commencement of transverse part, ascends to right beneath sternum, dividing opposite right sterno-clavicular articulation into *right common carotid* and *right subclavian* arteries (*vide* Arteries of Head and Neck).

Connections.—Lies behind manubrium and origins of sterno-hyoid and thyroid muscles. Trachea at first behind but afterwards to left side. On the right side lie the right innominate vein and right phrenic nerve.

Left common carotid (*vide* Arteries of Head and Neck).

Descending part : from lower border of body of 4th to that of 5th dorsal vertebra ; covered by pleura of left side.

No branches.

THORACIC AORTA.

Extent. From lower border of 5th dorsal vertebra (left side) to front of body of 12th dorsal vertebra.

Course and Relations.—Lies in posterior mediastinum ; is at first to left of bodies of vertebra, but afterwards gets in front.

In front. Root of left lung and pericardium.

Behind. Bodies of vertebræ and smaller azygos veins.

Left side. Covered by pleura.
Right side. Œsophagus, thoracic duct.

Branches.

Bronchial : supply structure of lungs. For the left lung two branches come off from front of aorta (superior and inferior). The artery supplying right lung arises either with or from superior left branch, or from 1st intercostal of right side.

Pericardial : small twigs to posterior surface of pericardium.

Œsophageal (4 or 5) : from front of aorta, running obliquely downwards to supply œsophagus ; *anas.* with one another, inferior thyroid and coronary of stomach.

Posterior mediastinal : supply glands, &c., of posterior nediastinum.

Intercostal (10 pairs) : arise from posterior part of aorta, un transversely outwards on bodies of vertebra and behind pleura to intercostal spaces. The right ones, crossing over ront of spine, supply the bodies of vertebra and pass behind esophagus, thoracic duct and azygos veins. The arteries of both sides are crossed by sympathetic nerve. On reaching ntercostal space they divide into anterior and posterior branches, the anterior branch crosses the space obliquely upwards, so as to get to lower border of upper rib near the ngle : at first it lies between external intercostal and fasciæ, ubsequently between two intercostal muscles ; *anas.* antelor intercostal of internal mammary, thoracic branches of xillary. Above the artery is a companion vein, and below ne intercostal nerve. The *posterior* branch passes backwards between vertebra and costo-transverse ligament, supplying vertebra, spinal cord.

(The 1st and 2nd intercostal arteries come from the subclavian trunk.)

ABDOMINAL AORTA.

Extent.—From last dorsal vertebra to little to left side of body of 4th lumbar vertebra, there dividing into common iliacs.

Course and Relations.—Enters abdomen between pillars of diaphragm, occupying middle line of spine, but near its bifurcation inclines to left side.

In front. From above, down; solar plexus, pancreas, splenic vein, left renal vein, 3rd part of duodenum, aortic plexus and peritoneum. It touches the pancreas and duodenum without any intervening peritoneum.

Behind. Bodies of lumbar vertebræ, embraced by crura of diaphragm above.

On right side. Vena cava inferior.

Branches.

Phrenic (2): arise close together on a level with under surface of diaphragm, pass across crura to under-surface of midriff, the left one passing behind œsophagus, the right one behind inferior vena cava.

Branches.

Internal: to fore-part of diaphragm; *anas.* fellow and superior phrenic of internal mammary.

External: to outer side of muscle; *anas.* musculo-phrenic, intercostal. Branches (*superior capsular*) to supra-renal body.

Cœliac axis: arises between pillars of diaphragm, just above pancreas, half inch long, surrounded by solar plexus; divides into three visceral branches.

Branches.

CORONARY OF STOMACH: smallest of three branches, directed upwards and to left side between layers of small omentum to cardiac end of stomach; gives off a few œsophageal branches, thence turns back along lesser curvature, giving branches on each side to viscus, finally *inosculates* with pyloric of hepatic.

HEPATIC: directed upwards and to right, between layers of small omentum, and anterior to *foramen of Winslow*, across to transverse fissure of liver, to left of bile duct and vena portæ; at transverse fissure it divides into *right* and *left* hepatic.

Branches.

Superior Pyloric: extends on lesser curvature from pyloric to cardiac end of stomach; *inosculates*, coronary.

Right gastro-epiploic: descends behind duodenum near pylorus, runs along great curvature of stomach from right to left, *inosculates* with left gastro-epiploic of splenic, gives off upwards, branches to viscus and downwards to omentum also: *inferior pyloric* to pylorus.

Superior Pancreatico-duodenal: arises opposite duodenum, runs between it and the pancreas down to *anas.* with inferior pancreatico-duodenal of superior mesenteric.

Cystic: given off from right hepatic, to supply gall-bladder.

SPLENIC: directed horizontally along upper border of pancreas to left side, supplying spleen and partly stomach and pancreas. Very tortuous, divides near spleen into several terminal branches, which enter hilus of that viscus.

Branches.

Pancreatic: given off as artery, run along pancreas; one of them (*arteria pancreatica magna*) accompanies the duct.

Left gastro-epiploic: directed to right side between layers of great omentum, along great curvature of stomach. *Inosculates* with right gastro-epiploic.

Gastric branches (*vasa brevia*) (5 or 6): extend to left extremity of stomach to supply its coats.

Suprarenal or middle capsular (2): arises a little below cœliac axis, runs transversely outwards over cura of diaphragm to supra-renal bodies; *anas.* superior capsular of phrenic and inferior capsular of renal.

Superior mesenteric: arise quarter inch below cœliac axis, directed down, terminating in off-sets to small intestine and cæcum.

Relations.—Behind, from above, down; pancreas, splenic vein, duodenum, left renal vein, surrounded by mesenteric plexus of nerves and accompanied by vena comes.

Branches.

Inferior pancreatico-duodenal: directed along concave border of duodenum; *anas.* superior pancreatico-duodenal.

Vasa intestina tenuis: to supply jegunum and ileum, twelve or fifteen in number; springing from left side of artery, about two inches from origin they bifurcate, the divided pieces unite with a neighbouring branch to form an arch, from which branches issue, which divide and communicate in the same way for four or five times, the resultant branches proceeding directly to intestine.

Ileo-colic: from right side of artery down to cæcum, branching to supply head of colon. A *descending* branch to lower part of ileum. An *ascending*) to ascending colon and *anas.* with right colic.

Right colic (often a branch of ileo-colic): from right side of trunk to middle of ascending colon, *ascending* branch *anas.* middle colic, *descending* branch *anas.* ileo-colic.

Middle colic: from upper part of right side of artery, *right* branch *anas.* right colic; *left* branch *anas.* on descending colon, with left colic of superior mesenteric.

Renal (2): one from each side arising half inch below superior mesenteric, the right a little lower than the left one, outwards to supply kidney. Each divides near viscus into four or five branches, which enter it between vein and ureter. Is accompanied by plexus of nerves, supplies branches to supra-renal body (*inferior capsular*), ureter and fat around.

Spermatic: two small but very long arteries; arise just below renal, directed downwards and out over psoas, cross ureter and external iliac artery, and the right the inferior vena cava, accompanied by spermatic vein and spermatic plexus. It accompanies spermatic cord, supplying testis: *anas.* artery of vas deferens. In the female the artery runs between layers of broad ligament of uterus to ovary and round ligament.

Inferior mesenteric: arises on left side of aorta, about one and a half inch above bifurcation. Lies at first on left side of aorta, then crosses over left common iliac; supplies sigmoid flexure and descending part of colon and part of rectum.

Branches.

Left colic: directed upwards in front of left kidney, *ascending* branch *anas.* middle colic; *descending* branch supplies descending colon.

Sigmoid: to sigmoid flexure; *anas.* left colic.

Superior hæmorrhoidal: continuation of inferior mesenteric trunk, passes behind rectum and divides in meso-rectum into two branches, which pass down, one on either side, to about six inches from anus, where they subdivide to supply rectum; *anas.* middle and interior hæmorrhoidals.

Lumbar (4 pairs): arise from back of aorta, pass outwards, resting on body of corresponding vertebra underneath psoas; the two upper pair under crura of diaphragm; the right ones also by vena cava divide near transverse processes into:

Abdominal: coursing beneath quadratus; *anas.* epigastric, internal mammary, intercostals, ilio-lumbar, circumflex iliac.

Dorsal: accompanies posterior primary branch of nerve, gives off *spinal* branch to supply meninges and cord; *anas.* intercostal.

Middle sacral: a small branch given off just at bifurcation, courses over 5th lumbar vertebra, middle of sacrum to coccyx; *anas.* lateral sacral.

THE COMMON ILIAC ARTERY.

Extent.—From bifurcation of aorta, on body of 4th lumbar vertebra, to opposite lumbo-sacral articulation, there dividing into external and internal iliac; about two inches long.

Relations. — *In front.* Peritoneum, intestines, ureter, branches of sympathetic.

Differences between right and left artery.—The *right* one is the longer, the aorta being on the left side of spine; on outer side is inferior vena cava and psoas. Companion vein at first internal, but external at upper part; left iliac vein beneath. The *left* one is crossed anteriorly by inferior mesenteric artery, the companion vein being beneath.

Branches.—None named, supplies peritoneum, psoas, ureters, and lymphatics. One of the renal, lumbar or ilio-lumbar vessels may come off from it.

THE INTERNAL ILIAC ARTERY.

1½ inches long.

Extent. From bifurcation of common iliac opposite lumbo-sacral articulation to great sacro-sciatic notch, there dividing into *anterior* and *posterior* trunks.

From the extremity a partly obliterated artery, the hypogastric, extends forwards to side of bladder, forming part of posterior false ligament. In the *fœtus* this vessel is nearly as large as the common iliac, ascends the wall of abdomen to umbilicus, passing thence to placenta ; after birth the vessel becomes obliterated except 1½ inches at commencement.

Branches from Anterior Trunk.

Superior vesical : is the unobliterated part of hypogastric, extending from sacro-sciatic notch to side of bladder.

Branches supplied to side and upper part of bladder, end of ureter.

Artery of vas deferens: accompanies duct to *anas.* with spermatic.

Inferior vesical : supplies fundus of bladder, side of prostate vesiculæ seminales (in the male).

Branch.

Middle hæmorrhoidal: supplies lower part of rectum and in the female to vagina. May come off from trunk ; *anas.* inferior hæmorrhoidal of pudic.

[**Uterine** : down to neck of uterus, passes between layers of broad ligament to supply body of viscus ; *anas.* ovarian.

Vaginal : corresponds to inferior vesical in male, supplies vagina, fundus of bladder, and lower part of rectum.]

Obturator : directed to groove in upper part of thyroid foramen, passing out of pelvis and dividing into two branches. In pelvis it is placed between pelvic fascia and peritoneum, and just below obturator nerve. Beneath pubes it lies with companion vein and nerve in canal, formed above by bone and below by thyroid membrane.

Branches within pelvis.

Iliac: enters iliac fossa, supplies iliacus and bone; *anas.* ilio-lumbar.

Pubic: ascends posterior surface of pubes; *anas.* opposite fellow, epigastric.

Branches outside pelvis.

Internal terminal: curves inwards beneath obturator externus, supplies obturator, gracilis, and adductors.

External terminal: descends beneath obturator externus to ischial tuberosity, supplies obturator and hamstrings.

Pudic, or **Internal Pudic.**

In the male. Proceeds out of pelvis by great sacro-sciatic notch below pyriformis, winds round ischial spine, re-enters pelvis by small notch, passes in obturator fascia on inner side of tuber ischii, entering perineal space, courses along pubic arch, ascends on and then perforates triangular ligament, dividing into dorsal of penis and artery of corpus cavernosum.

Relations. In the pelvis, lies to outer side of rectum, in front of pyriformis and sacral plexus. Thence, in company with vein and nerve, it is on external wall of ischio-rectal fossa, and internal to obturator internus, beneath triangular ligament crossed by deep transverse perineal muscle.

Branches.

Inferior hæmorrhoidal: arises just inside tuber ischii, crosses transversely ischio-rectal fossa, supply sphincter and levator ani; *anas.* middle hæmorrhoidal.

Superficial perineal: arises halfway in ischio-rectal fossa, runs parallel to pubic arch, between erector penis and accelerator urinæ, supplying them, together with scrotum; *anas.* superficial pudic of femoral.

Transverse perineal: arises from superficial perineal or from trunk near it, courses transversely inwards, supplying integuments, &c.

Artery of bulb: arises near base of triangular ligament, passes between the two layers of fascia, reaching bulb half inch from base. Supplies a branch to Cowper's gland.

Artery of corpus cavernosum: lies between crus penis and pubic ramus. Enters crus and is distributed to corpus cavernosum.

Dorsal artery of penis: lies between crus and pubic ramus, through suspensory ligament along dorsum of penis.

Artery in the female: The vessel is smaller and has similar course to that in male; the *superficial perineal* supplies labia pudendi. The *artery of bulb* supplies bulbus vestibuli. The terminal *dorsal* and *corpus cavernosum* arteries supply clitoris, being named dorsalis and profunda clitoridis respectively.

Sciatic: terminal branch of anterior trunk (*V.* arteries of lower limbs).

Branches from Posterior Trunk.

Gluteal: *V.* arteries of lower limbs.

Ilio-lumbar: passes outwards beneath psoas and obturator nerve, but anterior to lumbo-sacral cord; divides in iliac fossa into ascending or *lumbar* branch, supplying psoas, quadratus lumborum, and *spinal* branch through foramen between 5th lumbar vertebra and the sacrum. Transverse or *iliac* ramifies in iliacus, supplies bone; *anas.* lumbar, circumflex iliac.

Lateral sacral (2): *Superior*, the larger of the two, distributed to upper part of sacrum, the *Inferior* to lower, correspond to arteries; *anas.* middle sacral and opposite artery.

Branches (dorsal) are given off, which enter anterior sacral foramina for distribution on back of sacrum.

THE EXTERNAL ILIAC ARTERY.

Extent.—From bifurcation of common iliac opposite lumbo-sacral articulation to lower border of Poupart's ligament.

Course.—Line from ¾ inch below and little to left of umbilicus to point of Poupart's ligament midway between symphysis pubis and anterior superior iliac spine.

Relations.—Covered by peritoneum and sub-peritoneal fat, crossed by ureter and circumflex iliac vein. The spermatic vessels and genito-crural nerve, lying on it for a short distance.

To outer side, psoas, except at termination, when it is below. Inner side, vas deferens and lymphatic glands. The left vein is internal to its artery, but the right one is at first internal but at upper part beneath its artery.

Branches.

Epigastric : from fore part of artery, just above Poupart's ligament, down to ligament, then upwards and in between peritoneum and fascia transversalis ; terminates between rectus abdominis and sheath in anastomoses with internal mammary and inferior intercostal.

Branches.

Cremasteric : accompanies vas deferens, supplying cremaster ; *anas.* spermatic.

Pubic : ramifies behind pubes.

Muscular : to rectus ; *anas.* superficial epigastric.

Circumflex iliac : from outer side of artery, near Poupart's ligament, directed to anterior superior iliac spine, then on iliac crest, supplying iliacus, &c. ; *anas.* ilio-lumbar.

ARTERIES OF LOWER LIMB.

THE SCIATIC ARTERY.

Largest branch of internal iliac, except gluteal, goes out through lower part of great sacro-sciatic foramen, between pyriformis and superior gemellus, in company with great sciatic nerve and pudic artery, outside the pelvis it lies between the tuber ischii and great trochanter.

Branches.

Within the pelvis. Muscular to pyriformis, coccygeus, and levator ani.

Outside pelvis. Coccygeal branch, pierces great sacro-sciatic ligament, inclined inwards, supplies gluteus maximus integument, &c.

Comes nervi ischiatici : accompanies great sciatic nerve, finally enters the substance of it.

Muscular : branches to gluteus maximus and external rotators of thigh ; *anas.* gluteal, internal circumflex, superior perforating.

Articular : to capsule of hip-joint.

THE GLUTEAL ARTERY.

Largest branch of internal iliac, escapes from pelvis above pyriformis, divides immediately into superficial and deep branches.

Superficial branch : runs between the two larger glutei, supplying gluteus maximus ; *anas.* sciatic, posterior sacral.

Deep branch : goes between two smaller glutei, subdivides into two :

Superior division : goes to anterior superior iliac spine ; *anas.* circumflex iliac, ascending branches of external circumflex.

Inferior division : supplies gluteal muscles, and descends to great trochanter.

Nutrient branch : enters hip bone just as artery emerges from pelvis.

THE FEMORAL ARTERY.

Extent.—From Poupart's ligament to the opening in the adductor magnus.

Course.—Thigh being adducted and rotated out, a line drawn from middle of Poupart's ligament to internal condyle of femur.

Relations.—Superficial in upper ⅓, being contained in Scarpa's triangle, more deeply placed in lower ⅔.

In front. Skin, integuments, branch of anterior crural nerve, sartorius, long saphenous nerve, aponeurotic arch over Hunter's canal.

Behind. Psoas, profunda vein, pectineus, adductor longus, femoral vein (at lower part of Scarpa's triangle), adductor magnus.

Inner side. Femoral vein (in Scarpa's space), adductor longus, sartorius (in Scarpa's space).

Outer side.—Vastus internus, femoral vein (lower part).

Branches.

Superficial epigastric : arises half inch below Poupart's ligament, ascends in the saphenous opening to abdomen, as high as umbilicus, in the fascia of external oblique ; *anas.* superficial branches of deep epigastric, external mammary.

Superficial circumflex iliac : arises near preceding, runs outwards to iliac crest, supplies glands, fasciæ, and integument, psoas and iliacus ; *anas.* circumflex iliac, gluteal, external circumflex.

Superior external pudic : arises from inner side of artery half inch below Poupart's ligament, pierces fascia lata of saphenous opening, runs upwards to pubic spine, crosses external ring and spermatic cord, supplying integument of lower part of abdomen and external organs of generation ; *anas.* internal pudic.

Deep external pudic : arises either separately or from a common trunk with the preceding, lies on pectineus, covered by fascia lata, which it pierces, and is distributed to scrotum in male and labia in female ; *anas.* superficial perineal.

Profunda femoris : arises from outer and back part of artery, one or two inches below Poupart's ligament, resting in Scarpa's triangle upon the iliacus, subsequently resting upon adductores brevis and magnus, having the longus superficial to it, it ends in the lower third of thigh in a branch which perforates adductor magnus.

Branches.

External circumflex : arises from the outer side of the profunda (sometimes from the femoral trunk), coursing outwards through the divisions of the anterior crural nerve, dividing into: (a) *Transverse* branches, piercing vastus externus just below great trochanter; *anas.* on back of thigh with internal circumflex, perforating branches of profunda, gluteal, and sciatic. (b) *Ascending* passes beneath sartorius, rectus, and tensor vaginæ femoris; *anas.* with terminal of gluteal and external circumflex iliac. (c) *Descending* branches are distributed to the vasti, the one to the internal vastus; *anas.* with superior articular arteries, a small offset passing with the articular nerve to the knee-joint.

Internal circumflex: arises from the internal and back part of profunda, courses backward through psoas and pectineus, dividing at the small trochanter into two branches, one ascending to the digital fossa of the small trochanter; *anas.* sciatic and gluteal; the other passes to the hamstrings; *anas.* superior perforating. An articular branch enters the joint through the notch in acetabulum.

Perforating branches: four in number, reach the back of thigh by perforating the adductor magnus and end in the vasti:

First, begins opposite lower border of pectineus, perforates large and small adductors, distributed to biceps and gluteus maximus; *anas.* sciatic and internal circumflex.

Second, comes off opposite middle of short adductor, perforating it and the magnus, distributed to hamstrings; a nutrient artery (passing upwards) is given off; *anas.* other perforating branches.

Third, arises at the lower border of adductor brevis, perforates magnus, as the second.

Fourth, or terminal branch, pierces adductor magnus near opening for femoral vessels, supplies short head of biceps; *anas.* popliteal and lower perforating.

Muscular branches: two to seven in number, supplying sartorius and vastus internus.

Anastomotic branch: arises at the termination of the femoral, and courses in the line of the femoral to the interna condyle.

Branches.

External branch, crosses the femur, supplying branches to knee-joint; *anas.* superior external articular, forming an arch.

Deep branch, descends inner side of knee; *anas.* internal articular, recurrent of anterior tibial.

Superficial branch, accompanies long saphenous nerve to integument.

THE POPLITEAL ARTERY.

Extent.—From the opening in the adductor magnus to lower border of popliteus, dividing into anterior and posterior tibial.

Course.—Upper part inclines from inner side of femur to middle of intercondylar space, thence occupying middle line of popliteal space.

Relations.—The part of artery in the popliteal space is uncovered by muscles, but below it is covered by the gastrocnemius. It rests at first upon the femur and posterior ligament of knee-joint. The vein lies to the outer side in the upper part, but crosses to the inner side near the termination. Superficial and slightly external to the artery is the internal popliteal nerve; a small articular branch of the obturator courses upon the artery.

Branches.

Muscular: *Superior set* (3 or 4): to lower end of hamstrings; *anas.* perforating of profunda, superior articular.

Inferior set or sural (2): arise from the posterior part of artery opposite knee-joint, supply both heads of gastrocnemius, plantaris and soleus.

Superficial: accompanies external saphenous nerve to end in integuments.

Superior articular: *Internal.* Arises just above condyles of femur, course transversely beneath tendon of adductor magnus to front of knee, ending in vastus internus and joint; *anas.* anastomotic.

External. Winds beneath biceps, perforates intermuscular septum; *anas.* external circumflex anastomotic, forming an arch, inferior external articular; supplies joint by superficial and deep branches.

Inferior articular: *Internal.* Passes down between internal tuberosity of tibia and internal lateral ligament; *anas.* opposite artery, superior internal articular.

External. Courses outwards under outer head of gastrocnemius and external lateral ligament; *anas.* in front with other articular branches, anterior tibial recurrent.

Azygos articular: arises opposite flexure of joint, pierces posterior ligament, supplying crucial ligaments and other structures in the joint.

THE ANTERIOR TIBIAL ARTERY.

Extent.—From divisions of popliteal artery at lower border of popliteus to bend of ankle.

Course.—At first directed outwards, through two heads of origin of tibialis posticus, to reach anterior surface of interosseous ligament; thence a line drawn from inner side of head of fibula to midway between the two malleoli will mark its course.

Relations.—Tibialis anticus to inner side, the extensor communis digitorum above, and the extensor proprius pollicis below upon its outer side, covered below by annular ligament and crossed by extensor proprius pollicis tendon, rests below upon the anterior surface of the tibia. It is accompanied by two venæ comites. Anterior tibial nerve lies superficial and to the outer side.

Branches.

Recurrent: arises as artery reaches anterior surface of interosseous membrane, passes in tibialis anticus to external and anterior surfaces of knee-joint; *anas.* articular of popliteal.

Malleolar: two in number, arise just above ankle-joint, supplying it.

Internal. Passes beneath tibialis anticus tendon to inner malleolus; *anas.* branches of posterior tibial.

External. Passes outwards beneath extensor communis digitorum; *anas.* anterior peroneal, recurrent of dorsal of foot.

Muscular: to surrounding muscles.

Cutaneous: arising occasionally, the largest accompanying musculo-cutaneous nerve.

DORSAL ARTERY OF FOOT.

Extent.—From bend of ankle to 1st interosseous space, ending by inosculating with plantar arch and giving digital branches to great toe and half the next.

Relations.—Lies between tendons of extensor proprius pollicis and extensor longus digitorum; near termination it is crossed by innermost tendon of extensor brevis digitorum, bound down by fascia. Accompanied by two venæ comites. Anterior tibial nerve lies to outer side.

Branches.

Tarsal: arises as artery crosses scaphoid, courses forwards and outwards beneath extensor brevis digitorum, supplying it, then backwards to cuboid; *anas.* external plantar, metatarsal, external malleolar, peroneal.

Metatarsal: arises a little beyond the tarsal branch, directed outwards in an arched direction, beneath short extensor of toes to outer side of foot, near bases of metatarsal bones; *anas.* tarsal, external plantar. From the convexity of arch proceed three *interosseous* branches to three outer metatarsal spaces. They supply the interossei and divide at cleft of toes into digital branches; the most external one supplies also outer side of little toe. Each interosseous artery communicates with the digitals of the sole by an *anterior perforating* branch, and the plantar arch by a posterior perforating branch. The first interosseous (*dorsalis pollicis*) arises as artery, is about to dip down into sole, supplies inner and outer sides of great and inner half of 2nd toes.

THE POSTERIOR TIBIAL ARTERY.

Extent.—Lower border of popliteus to inner side of os calcis (origin of abductor pollicis).

Course.—At first midway between fibula and tibia, afterwards approaches tibia and lies posterior to it.

Relations.—Covered in upper part by gastrocnemius and soleus, more superficial lower down. Lies on tibialis posticus, flexor longus digitorum, tibia and ankle-joint. Has two venæ comites. In upper 4th posterior tibial nerve to inner side below it is external.

Relation of artery, at inner malleolus, from within out. Tibialis posticus and flexor longus digitorum tendons, vein, artery, vein, nerve, flexor longus pollicis tendon.

Branches.

Peroneal : arises one inch below popliteus, courses obliquely to fibula, then on posterior surface of that bone to outer malleolus of os calcis. Covered in upper part by soleus and deep fascia, and then by flexor longus pollicis ; beyond the malleolus it is superficial.

Branches.

Muscular: to soleus, tibialus posticus, flexor longus pollicis; and peronei.

Nutrient: to the fibula.

Anterior peroneal: arises about two inches above malleolus, pierces interosseous membrane, and under cover of peroneus tertius reaches front of outer ankle and tarsus, supplying ankle-joint ; *anas.* external malleolar and tarsal of anterior tibial.

Terminal: to *anas.* with external malleolar, tarsal, and posterior tibial.

Muscular : Soleus and deep muscles of back of leg.

Nutritious : arises near origin of posterior tibial, largest of kind in body.

Communicating : arises two inches above inner malleolus, courses beneath flexor pollicis ; *anas.* peroneal.

Calcaneal: to supply integument and fat of heel and muscles on inner side of foot; arises near ending.

INTERNAL PLANTAR.

The internal bifurcation of the posterior tibial, directed forwards along inner border of foot as far as 3rd interosseous space. Covered at first by abductor pollicis, and subsequently becomes more superficial by lying between that muscle and the extensor of toes; is accompanied by internal plantar nerve. Ends at 3rd interosseous space by *anas.* with 3rd digital artery of external plantar.

Branches.

Muscular: to abductor pollicis, flexor brevis digitorum, flexor brevis pollicis, two internal lumbricales.

Superficial digital: with digital branches of internal plantar nerve, which join at the roots of toes the deep digital arteries.

EXTERNAL PLANTAR.

From inner part of foot, with external plantar nerve, to base of 5th metatarsal; thence to inner border of root of great toe. As far as base of 5th metatarsal superficial, but rest forms *plantar arch* with communicating of *dorsalis pedis.*

The *plantar arch* is placed across the tarsal ends of the metatarsals.

Branches from the Plantar Arch.

Posterior perforating (3): ascend to dorsum of foot through posterior part of three outermost interosseous spaces; *anas.* interosseous of metatarsal.

Digital (4): supply both sides of three outer toes and outer half of next, bifurcating at the cleft of toes; give off at point of division, *anterior* perforating to *anas.* with interosseous of dorsum.

THE VEINS.

VEINS OF THE HEAD AND NECK.

Cerebral : noted for their thin coats, muscular tissue, and absence of valves.

Superior (7 or 8 on each side) : forwards and inwards to superior longitudinal sinus, there receiving interior cerebral, which drain the same hemisphere.

Anterior inferior : from under surface of anterior lobes ; terminate in cavernous sinus.

Inferior lateral (3 to 5) : terminate in lateral sinus.

Inferior median : from posterior lobe, &c., to straight sinus behind venæ Galeni.

Venæ Galeni (2, one from right, one from left ventricle) : formed by vena corporis striati and vena choroidea ; pass back and out of transverse fissure to straight sinus.

Cerebellar : superior, inferior, and lateral sets ; the 1st open into straight, the 2nd into lateral, the 3rd into superior petrosal sinuses.

Sinus (16 in number) : *Superior longitudinal :* begins at crista Galli, runs back over cerebrum to torcular Herophili ; receives superior cerebral and parietal veins.

Inferior longitudinal : along posterior part free margin of falx cerebri to straight sinus.

Tentorium (straight) : junction of tentorium and falx cerebri to torcular Herophili ; receives inferior longitudinal sinus, venæ Galeni, inferior median cerebral, and superior cerebellar veins.

Lateral (2) : from torcular Herophili to foramen lacerum posterius into internal jugular vein, receives straight and occipital sinus, &c.

Occipital (2) : smallest ; posterior margin of foramen magnum to torcular Herophili.

Cavernous (2) : sides of Sella Turcica from sphenoidal fissure to apex petrous part of temporal. Receives ophthalmic vein connecting the frontal with these sinus; also inferior anterior cerebral veins.

Circular: surrounds pituitary body, communicates with each cavernous.

Inferior petrosal (2): termination of cavernous to internal jugular vein.

Transverse: connects the inferior petrosal across basilar process of occipital.

Superior petrosal (2) on superior border petrous part of temporal, connecting lateral and cavernous; receives inferior lateral cerebral, anterior lateral cerebellar veins.

Facial: obliquely across side face from inner canthus, to unite, under inferior maxilla, to form a trunk to empty into internal jugular. Receives *supra-orbital*, *supra-palpebral*, *nasal*, *inferior palpebral*, *frontal*, *supra-orbital*, *supra-labial*, *inferior labial*, *buccal*, *masseteric*, *submental*, *inferior palatine* (which arises from plexus about tonsil, &c.), *submaxillary*, *ranine*; also communicates with ophthalmic (see cavernous sinus).

Temporal: from side and vertex of head, uniting with internal maxillary, forms temporo-maxillary. Receives *parotid*, *anterior auricular*, *transverse facial*.

Maxillary internal: *median meningeal*, *deep temporal*, *pterygoid*, *masseteric*, *buccal*, *palatine*, *inferior dental*, forms, with above, temporo-maxillary.

Temporo-maxillary: union of temporal and internal maxillary, descends in parotid gland and divides, one branch going to join facial, the other to external jugular. Receives posterior auricular.

Posterior auricular: plexus side of head, receives *stylo-mastoid* and branches from external ear; empties into temporo-maxillary.

Occipital (from plexus): back part vertex of skull deeply between muscles of neck lying in course of artery, to internal jugular. Receives *mastoid*, which communicates with lateral sinus.

External jugular: from temporo-maxillary near angle lower jaw, down into subclavian, accompanied by great auricular nerve. Has two pair of valves. Receives *occipital, post. ext. jugular* (draining superficial muscles of back of neck), *supra-scapular, transverse cervical.*

Anterior Jugular: drains integument and superficial muscles of anterior and middle portion of neck, emptying into subclavian. No valves.

Internal Jugular: from jugular foramen at junction of lateral and inferior petrosal sinus, vertically down the side of neck (outer side of main arteries), uniting with subclavian to form vena innominata; 1 pair valves, ¾ inch above termination. Receives *facial, lingual, pharyngeal, superior thyroid, middle thyroid.*

Vertebral: drains occipital region and deep muscles of back of neck; enters foramen in transverse process of atlas down through similar foramina of the cervical vertebræ to 6th (or 7th), where it passes out to enter vena innominata. Receives *posterior condyloid, muscular, dorso-spinal, meningeal, arachnidian, ascending and deep cervical*, 1 pair valves guard its mouth.

VEINS OF THE UPPER EXTREMITY.

Anterior ulnar: from anterior carpus and ulnar side hand, up along ulnar side forearm to elbow-joint, to form basilic. Communicates with median and posterior ulnar.

Posterior ulnar: posterior ulnar border hand and vein of little finger (*v. salvatella*)—unites with preceding just below elbow-joint.

Basilic: coalescence of anterior and posterior ulnar; receives median-basilic at elbow, ascends inner side arm to venæ comites of brachial artery, or axillary vein.

Radial: dorsum thumb, radial side index and hand—at bend elbow receives median-cephalic to become the cephalic.

Cephalic: up between deltoid and pectoralis major to axillary veins.

Bronchial: from lungs; the right terminating in azygos major; the left in the left superior intercostal.

Spinal: *dorsi-spinalis*: whole length of back of spine, forming network, terminating in the vertebral (of neck), the intercostal (of thorax), lumbar and saeral veins.

Longitudinales spinales anteriores: whole length vertebral foramen, anterior surface, terminating in dorsi-spinal.

Longitudinales spinales posteriores: whole length vertebral foramen, posterior surface, terminating in dorsi-spinal.

Vena basis vertebrarum: from bodies of vertebræ terminating in anterior longitudinal.

Medulli-spinales: cover cord, between pia and arachnoid from sacrum to occiput; *anas.* freely with those contiguous. No valves in any of the spinal veins.

Iliaca externa, **interna**, and **communis**: see Lower Extremity.

Vena cava inferior: junction of the two common iliacs, up on right side of aorta, terminating in lower or back part of right auricle. It receives: the *lumbar* branches (three or four in number) from muscles and integument of loins; the *right spermatic* (the left emptying into left renal), both having valves; (*ovarian* in the female), the *renal*, the left being the longer; the right *supra-renal* (the left terminating in the left renal or phrenic); the right *phrenic* (the left superior emptying into superior intercostal or internal mammary, and the inferior into the left renal); the *hepatic*, three branches (no valves), these commencing as the *intra*-lobular veins (in the centre of the lobule), forming the *sub*-lobular, and these last finally becoming the larger hepatic trunks.

Vena porta: 4 inches long; no valves in it or its branches; formed by *inferior mesenteric* (draining rectum, sigmoid flexure, and descending colon; its branches *inosc.* with internal iliac); *superior mesenteric* (draining small intestines, cæcum, ascending and transverse colon); *splenic* (five or six branches from spleen; receiving branches of vasa brevia, left gastro-epiploic, pancreatic, and pancreatico-duodenal veins); *gastric*, from lesser stomachic curvature.

Cardiacæ : *Vena cordis magna:* from apex, up anterior interventricular groove to base of ventricles, curving to left side and back part of heart, emptying into coronary sinus; guarded by two valves; receives posterior cardiac and left cardiac veins.

Vena cordis media (posterior cardiac): from apex up posterior interventricular groove, terminating in coronary sinus, guarded by valves.

Vena parvæ (anterior veins): three or four small branches from anterior surface of right ventricle, emptying into lower part right auricle.

Venæ thebesii: drains muscular substance, opening into right auricle.

Pulmonary : four in number; commence in capillary network upon bronchial cells, uniting to form a trunk for each lobe, the one of the middle lobe of the right lung unites with the one from the superior lobe, hence two veins from each side. No valves. Carry *arterial* blood.

VEINS OF THE LOWER EXTREMITY.

Internal or long saphenous : from plexus at dorsum and inner side of foot, ascends, in front of inner ankle, behind inner margin of tibia, bends behind inner condyle of femur, empties into femoral through saphenous opening, 1½ inches below Poupart's ligament, where it receives *superficial circumflex iliac*, *superficial epigastric*, and *superficial external pudic*. Communicates with internal plantar, tibial, &c. 2—6 valves.

External saphenous : from plexus at dorsum and outer side of foot, up behind outer ankle to median line of leg, accompanied by external saphenous nerve; empties into popliteal vein, between heads of gastrocnemius. Two valves, one near termination. Communicates with deep veins of foot.

Posterior tibial: formed from *external* and *internal plantar*, joining with the *peroneal*. Course same as artery.

Anterior tibial: continuation of *venæ dorsales pedis*, pierce interosseous membrane at upper part of leg, and form, by junction with the *posterior tibial* veins, the popliteal.

Popliteal (see anterior tibial): up to tendinous aperture of adductor magnus, there becoming the femoral; receives *sural*, *articular*, and *external saphenous* veins. Four valves. Crosses artery from within outwards.

Femoral (see above): up to Poupart's ligament; there becoming external iliac. Lies (below) to outside, but crosses beneath the artery to its inside. Receives *muscular* branches, and *profunda femoris*, together with the *internal saphenous*, 1½ inches below Poupart's ligament. Four or five valves.

External iliac (see above): to sacro-iliac symphysis, there uniting with internal iliac to form common iliac. On right side, lies to inside of artery at first, but gradually passes behind it. On *left* side, altogether on inside of artery. Receives *epigastric* and *circumflex iliac*. No valves.

Internal iliac: formed by venæ comites of *all* the branches of the iliac artery, but the umbilical; lies first to inside, but finally gets behind the artery. No valves, though the plexus that help form it are abundantly supplied. 1. *Hæmorrhoidal* plexus; 2. *vesico-prostatic* plexus; (3. *vaginal* plexus; 4. *uterine* plexus); 5. *dorsalis penis* plexus; these all intercommunicate very freely.

Common iliac (see external iliac): terminates at intervertebral substance between 4th and 5th lumbar vertebræ, there, with its fellow of opposite side, forms vena cava inferior. On the right it is the shorter, and nearly vertical. Receives *ilio-lumbar* and sometimes *lateral sacral* veins. *Middle sacral* empties into left common iliac. No valves.

THE SPINAL CORD AND ITS MEMBRANES.

THE MEMBRANES OF THE CORD.

The dura mater is the most external membrane, and is continuous with that investing the brain, but it does not form the endosteum of the vertebræ, nor has it any sinuses, but it is separated from the bones by areolar tissue and a plexus of veins. It is connected above with the edge of the foramen magnum; at the top of the sacrum it becomes impervious and is continued as a slender cord to blend with the periosteum of the coccyx. This membrane gives sheaths to all the spinal nerves.

The arachnoid is a thin serous membrane investing the outer surface of the cord and the inner surface of the dura mater. (Some now hold that the inner surface of the dura mater is not covered by the arachnoid.)

The cavity between the arachnoid and the cord is termed the **subarachnoid** space, and contains the subarachnoid fluid.

The pia mater is the most internal coat, and covers the entire surface of the cord. It is more fibrous and less vascular than the pia mater of the brain. A process, the *linea splendens*, is sent into the anterior median fissure at the first lumbar vertebræ; it ends in a slender cord, the *filum terminale*, which is within the prolongation of the dura mater.

The ligamentum denticulatum is found between the anterior and posterior roots of the nerves; it consists of a number of serrations of the pia mater attached externally to the dura mater, and serves to support the cord.

THE SPINAL CORD

Is contained in the spinal canal, occupying in adults about ⅔ of the length of it, but in the fœtus, before the 3rd month, it occupies the whole of the canal.

Contents of the Neural Canal.

Venous plexus between bone and dura mater.

Membranes.
- Dura mater.
- Arachnoid.
  - Parietal layer.
  - Visceral layer.
- Pia mater, with ligamenta denticulata.

Cerebro-spinal fluid.

Spinal vessels.
- Anterior spinal artery and vein.
- Two posterior spinal arteries and veins.

Spinal cord, with anterior and posterior roots of nerves.

Extent.—The spinal cord extends from lower border of the foramen magnum to the lower border of the 1st lumbar vertebra, there terminating in a slender filament of grey matter, extending for some distance, called the *filum terminale.*

Shape.—A transverse section would be oval, being elongated from side to side.

Enlargements.—Presents two enlargements upon its surface. The upper or *brachial* is the larger of the two, corresponding to the origin of the brachial plexus, enlarged laterally. The lower or *crural* corresponds to the origin of the lumbar and sacral plexuses, which form the *cauda equina;* is more bulbous than the upper one.

FISSURES.

Anterior median fissure: in longitudinal direction along the middle line, extending into the substance of the cord for about one third its thickness, but deeper below than in the upper part; lined with pia mater.

Posterior median fissure: narrower than the preceding, but extends into the cord for nearly half its thickness; contains a septum of pia mater.

The cord being thus divided into two lateral halves, may again be subdivided into *anterior*, *lateral*, and *posterior* columns.

The *posterior* and *lateral* columns are divided by a groove or lateral sulcus, to which the posterior nerve roots are attached.

The *anterior* and *lateral* columns are separated by the anterior roots of the nerves.

Posterior median column is formed by a groove a little outside the posterior median fissure, dividing the posterior column into two parts. A posterior median column and posterior column proper.

Central canal: in the interior of the cord is a central canal, lined with spheroidal ciliated epithelium, and opening into the cavity of the 4th ventricle.

THE BRAIN AND ITS MEMBRANES.

THE MEMBRANES.

THE DURA MATER: the most external, is a dense fibrous membrane, outer surface rough and forms the endosteum of the bones of the skull. The inner surface is smooth, and covered by the arachnoid. It is continuous with the dura mater of the spinal cord through the foramen magnum. In certain parts the fibrous layers of this membrane separate to form the *sinuses* of the dura mater. On the upper surface are the *Pacchionian* bodies. There are certain processes of the dura mater, viz.:

The falx cerebri: placed vertically between the two hemispheres of the cerebrum, attached in front to the crista galli and behind to the internal occipital protuberance and the tentorium.

The tentorium cerebelli is placed horizontally between the cerebrum and the cerebellum. It is attached in front to the anterior and posterior clinoid processes, superior edge of the petrous bone, and behind to the upper margin of the lateral sinus.

The falx cerebelli reaches vertically from tentorium to the foramen magnum, dividing the two hemispheres of the cerebellum. It is attached posteriorly to the vertical crest of the occiput, and below on either side of the foramen magnum.

THE ARACHNOID resembles that of the spinal cord, and consists of a *parietal* and *visceral* layer.

The *visceral* layer invests the brain, covering the pia mater. It is thicker at the base, and dips down into the great longitudinal fissure. It stretches across between the two middle lobes, forming the *anterior subarachnoid space*, which is just anterior to the pons. Beneath the cerebellum it forms in a like manner, by stretching from the cerebellum to the medulla, the *posterior subarachnoid space.*

THE PIA MATER is very vascular, and dips down between the convolutions, and gives off processes to the interior of the brain.

THE BRAIN.

The brain is contained in, and nearly corresponds to, the cranial cavity.

It is divided into four parts :

(1) **Cerebrum** : the highest and largest, being nearly $\frac{7}{8}$ of the whole, occupies vault, middle and anterior fossæ of the skull, divided into two hemispheres by the longitudinal fissure down which the falx cerebri dips.

(2) **Cerebellum** : contained in the posterior fossa, lying under part of the base of the cerebrum, but separated from it by tentorium cerebelli, divided into two lateral halves by the falx cerebelli.

(3) **Medulla oblongata** : extends from the cord to the Pons Varolii, lying just above the foramen magnum.

(4) *Pons Varolii:* form a process to connect all the other three parts together.

Weight of the brain.—Average in the male 50 oz., in the female 45 oz. At birth the brain is relatively to the weight of the body five or six times heavier than in adults. The weight may be thus distributed: cerebrum 44 oz., cerebellum 5 oz., pons and medulla 1 oz.

THE MEDULLA OBLONGATA, OR BULB.

Extent.—From the lower border of the foramen magnum to the lower border of the pons.

Dimensions.—1¼ inch long, ¾ inch wide.

Shape.—Pyramidal, with base to the pons and apex to spinal cord.

Surfaces.—Anterior lies in basilar groove; posterior forms lower half of floor of the 4th ventricle.

FISSURES.—Anterior and posterior median fissures, continuous with those of the cord.

Anterior median fissure: terminates just below the pons in the foramen cæcum, and at the upper part the fibres of one side cross over to the other, forming the decussation of the pyramids.

Posterior median fissure: reaches only half way up, widening out and gradually getting lost in the 4th ventricle.

EMINENCES.—Each lateral half of the bulb is subdivided into four columns, named from within out: *anterior pyramid*, *olivary body*, *restiform body*, and *posterior pyramid.*

Anterior pyramid: is the continuation of the anterior column of the cord; it is external to the median fissure and internal to the olivary body. It enters the pons, enlarging as it ascends, but before it disappears becomes constricted. The innermost fibres decussate with one another.

Olivary body: an oval body, half inch long, lying between the anterior pyramid and restiform body, but separated on either side by a slight groove, as it is also from the pons above.

Lateral tract: continuous with the lateral column of the cord, lying between olivary and restiform bodies.

Restiform body: continuous with the posterior column of the cord, and separated from both the posterior pyramid and lateral tract by a slight groove. It diverges from its fellow in the upper half, and enters the cerebellum, receiving the name of *inferior peduncle of the cerebellum.*

Posterior pyramids: bound the apex of 4th ventricle and then dip down to form floor.

THE PONS VAROLII.

Position.—Placed above the medulla below the crura cerebri, and between the halves of the cerebellum.

Dimensions.—About 1 inch or 1½ inch long; measures a little more transversely.

Anterior surface: is convex, grooved along the centre for the basilar artery; the surface is marked with openings for the entrance of vessels.

Posterior surface: smaller than the anterior, and continuous with the posterior surface of bulb; forms the upper part of the floor of the 4th ventricle.

Upper border: longer than the inferior, with a notch in median line corresponding to groove on anterior surface. It arches over the cerebral peduncles.

Lower border: straight, overlays bulb.

Laterally: the pons is continued backwards and outwards, and is continued as the *middle peduncle of the cerebellum.*

THE CEREBRUM.

Consists of two lateral halves or hemispheres, partly separated by the longitudinal fissure, which runs from before backwards; in front it entirely divides the hemispheres, but in the middle line they are connected by the *corpus callosum.* The inferior surface is divided into two parts transversely by the *fissure of Sylvius.*

BASE OF THE CEREBRUM.

The following objects are seen near the middle line from behind forwards:

Crura cerebri.
Posterior perforated spot.
Corpora albicantia.
Tuber cinereum.
Infundibulum.
Pituitary body.
Optic tract.
Optic commissure.
Anterior perforated spot.
Lamina cinerea.

In the longitudinal fissure.
Rostrum of corpus callosum.

Crura cerebri: extend from pons to optic thalamus; ¾ inch long, widening at the cerebrum; between the crura is the interpeduncular space, containing posterior perforated spot, corpora albicantia, and tuber cinereum. The grey matter of the interior, from its dark colour, is called *locus niger.*

Posterior perforated spot: is placed between the two crura; it is perforated by vessels passing to the optic thalamus.

Corpora albicantia: two small white bodies, formed by a doubling upon themselves of the anterior crura of the fornix.

Tuber cinereum: a grey body placed behind the *optic commissure;* from its under surface a tubular process, the *infundibulum*, extends, which joins it to the *pituitary body*, a reddish vascular mass lying in the sella turcica.

The optic commissure is the point of junction of the two optic nerves.

The anterior perforated spot: situated at the inner end of the fissure of Sylvius, perforated by branches of the middle artery.

Lamina cinerea: a layer of grey matter, passing from the end of the corpus callosum to the tuber cinereum.

Corpus callosum: this bends anteriorly very abruptly and forms the genu or rostrum.

THE UPPER SURFACE OF THE CEREBRUM.

The cerebrum is divided into two hemispheres by the *longitudinal fissure*, at the bottom of which is the corpus callosum.

The surface presents eminences called *convolutions*, and the intervals between them are named *sulci*.

The fissure of Sylvius separates the anterior and middle lobes at the base of the brain, and as it ascends it divides into a horizontal part, which separates the temporal and frontal lobes, and a vertical, which loses itself between the convolutions of the frontal lobe.

THE INTERIOR OF THE CEREBRUM.

The *centrum ovale minus* is the central white mass of a hemisphere; the *centrum ovale majus* is centrum ovale minor of each side, joined by the corpus callosum.

The corpus callosum is the commissure of the cerebrum, the fibres passing from one hemisphere to the other. Along the upper surface in the middle line is a raphè, on either side of which are the longitudinal fibres, the *nerves of Lancisi*, external to which are some transverse marks, the *lineæ transversæ*.

The lateral ventricles are two in number, one in each hemisphere, being separated by the *septum lucidum*. Each consists of a body or central cavity and three *cornua*, an *anterior*, turning forwards and outwards in the anterior lobe; a posterior, directed backwards and outwards in the posterior lobe, containing a longitudinal eminence, the *Hippocampus minor*, and a descending one, to be described afterwards.

Boundaries.—The *roof* is formed by the corpus callosum, the *floor* from before back by corpus striatum, tænia semicircularis, thalamus opticus, choroid plexus, corpus fimbriatum, fornix.

The corpus striatum : is the *superior ganglion of the cerebrum ;* it is pyriform in shape, with the larger end directed forward.

Tænia semicircularis: a narrow band of white fibres connecting the corpus striatum and optic thalamus.

The optic thalamus: a white oblong mass resting upon the crus cerebri.

Boundaries.—Externally. Corpus striatum and tænia semicircularis. *Internally.* Forms lateral boundary of 3rd ventricle, and along the upper border is the peduncle of the pineal gland. *Superiorly.* It is partly covered bv the fornix, and in front is the anterior tubercle. *Inferiorly.* It projects into the descending cornu and presents the internal and external geniculate bodies.

The choroid plexus is formed by a process of the pia mater. It is connected with the one on the opposite side through the *foramen of Monro.*

The corpus fimbriatum is the thin edge of fornix.

The fornix is placed in the middle line beneath the corpus callosum. It divides anteriorly into two crura, which have been seen to form the corpora albicantia; posteriorly it joins the hippocampus major.

The 5th ventricle is situated between the layers of the *septum lucidum;* it is lined by a serous membrane which in the fœtus communicates with the 3rd ventricle.

The descending cornu passes backwards, outwards, and downwards, and curving round the crus cerebri, goes forwards and inwards; the floor is formed by the following:

The hippocampus major: the continuation of the fornix; it has an enlarged anterior extremity, *pes hippocampi.*

Tænia hippocampi: the continuation of the tænia semicircularis, under which is the *fascia dentata.*

The choroid plexus: continuous with that of the lateral ventricle.

The pes accessorius or *eminentia collateralis:* a projection between the hippocampus major and the minor just at the beginning of the descending cornu.

The transverse fissure is opposite the interval between the cerebrum and cerebellum, and through the pia mater passes to the interior of the brain.

The velum interpositum is a process of pia mater which passes into the brain by the transverse fissure. In the centre of it are the two *venæ Galeni*, and on each side the choroid plexus.

The 3rd ventricle is the fissure between the optic thalami. *Boundaries.—Roof*, formed by fornix and velum interpositum. *Floor*, by structures at base of brain within the circle of Willis. *Anteriorly*, is the anterior commissure, connecting the corpora striata. *Posteriorly*, the posterior commissure, connecting the optic thalami. The middle commissure, also connecting the optic thalami, passes across the ventricle.

It communicates with the lateral ventricles by the foramen of Monro and with the 4th ventricle by the aqueduct of Sylvius.

The pineal gland is a conical body placed between the nates. Its base is connected with the optic thalami by two anterior peduncles, and to the posterior commissure by small inferior peduncles.

The corpora quadrigemina are four small bodies placed in pairs behind the 3rd ventricle, the anterior pair being called the *nates* and the posterior the *testes*. There are two bands passing from the cerebellum to the testes, sometimes called processus a cerebello ad testes, and between these is the valve of Vieussens, which gives origin to the 4th pair of nerves. The corpora quadrigemina receive from below the *fillet of the olivary body*.

THE CEREBELLUM.

The cerebellum is contained in the occipital fossa, and is separated from the cerebrum by the tentorium. The surface is divided into laminæ, which are separated by sulci.

The upper surface presents in the median line a ridge called the *superior vermiform process*, and each half of the cerebellum is divided into an anterior and posterior lobe by a fissure. *The anterior lobe* reaches from the posterior part of the vermiform process forwards. The *posterior* lobe is the remaining part. The cerebellum is connected to the cerebrum and cord by three peduncles:

The superior peduncle is the processus a cerebello ad testes; between the two peduncles is a layer of white fibres connecting them, called the valve of Vieussens.

The middle peduncle forms the transverse fibres of the pons varolii.

The inferior peduncle connects the cerebellum and the medulla and form part of the restiform bodies.

The inferior surface of the cerebellum is divided into two by a fissure, on the floor of which is the *inferior vermiform process*, which is divided as follows: most anteriorly is the uvula, with a projection forwards of it called nodule, and behind is the pyramid and a few transverse fibres.

The under surface of each hemisphere is divided into lobes, which are named from behind forwards: the *posterior lobe*, the *slender lobe*, the *biventral lobe*. Between the latter and the medulla is the *amygdaloid lobe* or *tonsil*, and in front of the biventral lobe on the crus cerebelli (the under surface being directed upwards), is *flocculus* or subpeduncular lobe.

The 4th ventricle: *Boundaries.—Floor* formed by pons and medulla. *Roof* by valve of Vieussens and inferior vermiform process. Laterally by the superior peduncles. *Below.* Restiform body. The cavity communicates with the 3rd ventricle by the aqueduct of Sylvius.

The ventricle is closed below by a reflection of pia mater, which joins the *choroid plexus* of the 4th ventricle. In the floor is a median groove continuous with the central canal of the cord, and on each side of the groove is a body, the *fasculus teres*. The lower part is bounded by the ends of the posterior pyramids, and is termed the *calamus scriptorius*.

THE NERVES.

NERVES OF HEAD AND NECK.

CRANIAL NERVES, 9 pairs (Willis).

1st or **Olfactory**: *Origin* by three roots. *External*, from corpus striatum. *Middle*, from anterior lobe. *Internal*, back part of anterior lobe.

Course.—The three roots unite in a prismatic band, which passes forwards on either side of longitudinal fissure, resting on cribriform plate and expanding at end into olfactory bulb.

Distribution.—About twenty prolongations given off from under surface of bulb through ethmoidal foramina, to supply Schneiderian membrane.

Special function.—Smelling.

2nd or **optic**: *Origin*, from optic tract, which comes from the corpora geniculata, quadrigemina, and optic thalamus.

Course.—Winds across inferior surface of crus cerebri, uniting with fellow to form optic commissure, which is bounded in front by the lamina cinerea and behind by the tuber cinereum; the nerves separate at fore part of commissure, get ensheathed in arachnoid, and pass into orbit through optic foramen; whilst passing through receive a tube of dura mater, which divides into two, the upper piece becoming orbital periosteum. The nerve pierces sclerotic and choroid coat of eye-ball.

Distribution.—Expands to form retina.

Special function.—Nerve of sight.

3rd: *Origin.*—Inner side of crus cerebri, just in front of pons.

Course.—Passes forwards to pierce dura mater on outer side of anterior clinoid process; then along outer wall of cavernous sinous, divides into two branches, entering orbit through sphenoidal fissure, between the two heads of external rectus.

Distribution.—Superior branch supplies superior rectus and levator palpebræ. Inferior divides into three, one for internal rectus, another to inferior rectus, and the other for inferior oblique, and a branch to lenticular ganglion.

Special function.—Motor nerve.

4th or **pathetic**: *Origin.*—Valve of Vieussens, just behind testis.

Course.—Passes forwards in outer wall of cavernous sinus below 3rd, but enters orbit through sphenoidal fissure above the other nerves.

Distribution.—Enters *orbital* surface of superior oblique.

Special function.—Motor nerve.

5th or **trifacial**: *Origin.*—By anterior and posterior roots, the latter having a ganglion on it, from the side of pons.

Course.—The two roots pass forwards through oval opening in tentorium cerebellum, the posterior root entering the Gasserian ganglion, lodged on the petrous part of temporal bone. The anterior root passes under ganglion and is not connected with it, but goes through foramen ovale, uniting with the internal maxillary from the ganglion.

The Gasserian ganglion: lodged in a depression near apex of petrous part of temporal, gives off from its anterior edge the *ophthalmic*, *superior maxillary*, and *inferior maxillary;* all consist of grey fibres, except the inferior maxillary, which consists of both grey and white.

OPHTHALMIC or 1st division of the 5th (sensory): about 1 inch long, passes along outer wall of cavernous sinus below other nerves, enters orbit by sphenoidal fissure, having previously divided into:

Lachrymal: supplying gland, conjunctiva, and communicating with orbital of superior maxillary, finally pierces upper eyelid, joining facial.

Frontal: largest branch, enters above muscles, divides into:

Supra-trochlear: directed outwards between pulley and supra-orbital notch; distributed to forehead.

Supra-orbital: passes through notch, supplies palpebral filaments, ending on forehead: corrugator supercilii, occipito-frontalis, orbicularis palpebrarum.

Nasal: enters orbit between heads of rectus externus, enters anterior ethmoidal foramen, re-enters cranium, passes down slit by side of crista galli into nose, dividing into:

Internal, for mucous membrane.

External, for skin of ala and tip of nose.

Branches from Nasal in the Orbit.

Ganglionic: to form long root of lenticular ganglion.

Ciliary: pierce sclerotic, distributed to ciliary muscle and iris.

Infra trochlear: given off as nerve, enters ethmoidal foramen: to inner angle of eye, communicates beneath 'pulley' with supra-trochlear, supplies lachrymal apparatus, orbicularis palpebrarum, eyelids, and side of nose.

LENTICULAR GANGLION: a small reddish-coloured ganglion, placed between optic nerve and rectus externus. Possesses three roots, entering posterior border; from the anterior border proceed the short ciliary nerves (ten or twelve).

SUPERIOR MAXILLARY (sensory): passes from middle of ganglion through foramen rotundum, then across spheno-maxillary fossa to enter infra-orbital canal, emerging on face at infra-orbital foramen, beneath elevator of upper lip; it divides under this muscle into a number of branches for nose, eyelid, and lip, joining with the facial nerve to form infra-orbital plexus.

Branches given off in the Spheno-maxillary fossa.

Orbital or *Temporo-malar:* divides into *temporal,* which, communicating with the lachrymal, enters temporal fossa through malar foramen, and there communicates with facial and auriculo-temporal. *Malar* perforates malar foramen and orbicularis, joining facial on cheek bone.

Spheno-palatine (2): to Meckel's ganglion.

Posterior dental: anterior branch to gums and buccinator. Posterior branch passes through superior maxilla, supplies molar, bicuspids, &c.; joins anterior dental.

Branches arising in the Supra-orbital Canal.
Anterior dental: enters canal of anterior wall of antrum, joins the posterior dental, supplying front teeth and inferior meatus.

Branches arising on the Face.
Palpebral: to supply orbicularis, conjunctiva of lower lid, and join facial and malar of orbital.
Nasal: to integument of nose; joins nasal of ophthalmic.
Labial: to muscles, integument, and mucous membrane of mouth.

SPHENO-PALATINE or MECKEL'S GANGLION: deeply placed in spheno-maxillary fossa; possesses a motor root from facial, a sensory one from the 5th, and a sympathetic one from carotid plexus.

Branches.
Ascending: to periosteum of orbit.
Descending: form the *anterior palatine* nerve, through posterior palatine canal to hard palate; branches are also given to the middle and inferior meatus. *Middle* or *external palatine*, to tonsil, uvula, and soft palate. *Posterior* or *small palatine*, to gums and soft palate.
Internal: superior nasal (4 or 5), to mucous membrane of superior meatus, &c. *Naso-palatine* goes, like preceding, through spheno-palatine foramen to palate.
Posterior: Vidian, through Vidian canal to foramen lacerum, dividing into *carotid* or *deep petrosal* to join carotid plexus and *superficial petrosal*, which passes in a groove in the petrous to hiatus fallopii. *Pterygo-palatine*, to Eustachian tube.

INFERIOR MAXILLARY: largest of three divisions. The large sensory root from inferior angle of Gasserian ganglion, joins small motor root as it emerges from foramen ovale. The nerve divides into anterior and posterior trunks.

Branches from Anterior Division.
Masseteric: outwards over sigmoid notch with artery to masseter.

Deep temporal (2): anterior, to front of temporal fossa. Posterior, to back of temporal fossa.

Buccal: comes out between heads of external pterygoid to buccinator; joins facial branch.

Pterygoid: Internal, to deep surface of internal pterygoid, connected near origin with otic ganglion. External, to external pterygoid (generally given off from buccal).

Branches from the Posterior Division.

Auriculo-temporal: by two roots, between which the middle meningeal artery passes. Goes up with temporal artery beneath parotid to temporal fossa.

Branches of the Auriculo-temporal.

Inferior auricular: to ear below meatus.

Superior auricular: to integument of tragus and pinna.

Communicating: to otic ganglion and facial.

Anterior temporal: to top of skull with artery, joins supra-orbital and lachrymal.

Posterior temporal: to attrahens aurem, &c.

Parotid: to gland.

Temporo-maxillary: to joint.

INFERIOR DENTAL: passes with artery beneath external pterygoid to inferior dental foramen, runs along canal, supplying teeth, ending at mental foramen in two branches. *Incisor*, forwards to symphysis for front teeth. *Mental*, coming out foramen, supplies orbicularis oris and mental muscles, communicates with facial nerve. *Mylo-hyoid*, given off as nerve enters canal, descends groove to mylo-hyoid muscle and anterior belly of digastric.

GUSTATORY OF LINGUAL: *Special function:* taste. Lies at first beneath external pterygoid; being joined by the *chorda tympani*, it then passes to ramus of jaw and crosses to side of tongue over the superior pharyngeal constrictor and Wharton's duct. Communicates with submaxillary ganglion and hypoglossal. Supplies gums, papillæ, and mucous membrane of sides and tip of tongue.

THE OTIC GANGLION (Arnold's): *Position:* near foramen ovale, attached to internal pterygoid nerve. Has three roots. *Motor* from inferior maxillary. *Sensory* from auriculo temporal (facial). *Sympathetic* from plexus of middle meningeal artery.

THE SUBMAXILLARY GANGLION.—*Position:* between hyoglossus and inner part of submaxillary gland. *Motor*, root from gustatory. *Sensory*, from chorda-tympanum. *Sympathetic*, from plexus round facial artery. *Branches*, to submaxillary gland and its duct.

6th or **abducens oculi**: *Origin.*—From the corpus pyramidale and from the lower border of the pons.

Course.—Pierces dura mater to reach cavernous sinus; lies to outer side of internal carotid, and below the other nerves. Enters orbit by sphenoidal fissure, lying above ophthalmic vein.

Distribution.—External rectus.

Relations.—The following table shows how the nerves of the orbit change their position to one another; they lie from above down:

In the Cavernous Sinus.	*In the Sphenoidal Fissure.*
Third.	Fourth. Frontal. Lachrymal.
Fourth.	(Above the muscles).
Fifth.	Sup. division of 3rd.
Sixth.	Nasal of 5th.
	Infr. division of 3rd.
	Sixth.
	(Enter between heads of external rectus).

7th consists of the **facial** or **portio dura**, and the **auditory** or **portio mollis**.

FACIAL or **portio dura** (motor): *Origin.*—From the groove between the olivary and restiform bodies of medulla.

Course.—Passes forwards, entering internal auditory meatus; it lies upon a groove on the *porti mollis*, enters the aqueductus Fallopii; emerging from the bone at the stylo-mastoid foramen, it then passes into the parotid, dividing behind the ramus of jaw into *temporo-facial* and *cervico-facial.*

COMMUNICATIONS.—In the meatus, with *auditory.* In the aqueductus with *Meckel's ganglion* by large petrosal. *Otic ganglion* by small petrosal. *Plexus on middle meningeal* by external petrosal. At exit from foramen: with *pneumogastric, glosso-pharyngeal, carotid plexus, great auricular, auriculo-temporal.* On the face: with *three divisions of the 5th.*

Branches within the Aquæductus.

Tympanic: for intrinsic ear muscles.

Chorda-tympani: given off just before exit from foramen, ascends to back of tympanum, emerges from bone through Huguier's foramen at inner end of Glasserian fissure, forwards between the two pterygoids to join the gustatory, forms the motor root of submaxillary ganglion, and finally ends in the tongue.

Branches given off at exit from Foramen.

Posterior auricular: passes up behind and between mastoid process and meatus, dividing into *auricular* to supply retrahens aurem, and *occipital* to skin, &c., of occiput; communicates with auricular of pneumo-gastric, great auricular, and small occipital.

Stylo-hyoid: to muscle.

Digastric: to supply posterior belly of digastric and join glosso-pharyngeal.

Branches on the Face.

Divides near ramus of inferior maxilla into temporo-facial and cervico-facial. The *temporo-facial* crosses over external carotid, communicating with auriculo-temporal and supplying pinna.

Branches of the Temporo-facial.

Temporal: supply attrahens aurem, joining temporal of superior maxillary and auriculo-temporal of inferior maxillary; anterior branches supply orbicularis palpebrarum and occipito-frontalis.

Malar: to supply eyelid muscles and join supra-orbital.

Infra-orbital: Superficial, to skin and superficial muscles of face, join infra-trochlear. Nasal (5th): deep, to elevators of upper lip and angle of mouth, join infra-orbital of superior maxillary.

Cervico facial: supplies a few branches to parotid and communicates with great auricular.

Branches of the Cervico-facial.

Buccal: to buccinator; joins buccal of inf. maxillary.

Supra-maxillary: to muscles of lip and chin; join mental branch of inferior dental.

Infra-maxillary: beneath lower jaw to join superficial cervical and supply platysma.

AUDITORY or **portio mollis**: *Origin.*—By *lineæ transversæ* from floor of 4th ventricle.

Course.—Round restiform body to posterior border of crus cerebelli with facial. Enters internal auditory meatus, dividing at the bottom into *cochlear* and *vestibular* branches.

Distribution.—*Cochlear,* enters foramen spiralis and supplies cochlea. *Vestibular,* to vestibule and semicircular canals.

8th consists of **glosso-pharyngeal**, **pneumo-gastric**, and **spinal accessory** (8th, 9th, 10th of Sœmmering).

GLOSSO-PHARYNGEAL: *Origin.*—From the upper part of lateral tract, the medulla.

Course.—Passes outwards over the flocculus to the jugular foramen, leaving the skull with the other two branches of the 8th, but in a separate tube of dura mater and in front of them, being contained in a canal in the petrous part of the temporal bone. It presents near point of exit two ganglion enlargements—the *jugular* and *petrous.* Leaving the skull, the nerve passes between the internal carotid artery and jugular vein, downwards behind the muscles attached to the styloid process to reach the lower border of the stylo-pharyngeus. Thence it is inclined inwards beneath the hylo-glossus to the tongue, pharynx, and tonsil.

The jugular ganglion : the smaller of the two, is situated at the upper part of the groove in the temporal, through which the nerve passes. It involves only the outer side of the trunk of the nerve.

The petrous ganglion : placed in a depression on the inferior border of the petrous, involves all the fibres of the nerve, and from which communicating filaments to the other cranial nerves arise ; *viz.*, to the pneumogastric, sympathetic, and facial.

Branches.

Tympanic (Jacobson's nerve) : arises from the petrous ganglion, enters a minute canal in the bone between jugular foramen and carotid canal to reach the tympanum. It divides into six branches, Three *branches of communication* to carotid plexus, greater superficial petrosal nerve, and Otic ganglion respectively. Three *branches of distribution* to the fenestra ovalis, fenestra rotunda, and membrane of the Eustachian tube respectively.

Carotid.—Descend along the internal carotid artery, communicating with pharyngeal of pneumogastric and sympathetic.

Pharyngeal (3 or 4) : join opposite the middle constrictor with pharyngeal of pneumogastric and sympathetic, supplying the mucous membrane of the pharynx.

Muscular : to stylo-pharyngeus and constrictor muscles.

Tonsillitic : to the tonsil and thence to fauces and soft palate.

Lingual (2) : one branch distributed to the base, the other to the side of the tongue.

Special functions.—Nerve of sensation to the mucous membrane of pharynx, fauces and tonsil ; of motion to the pharyngeal muscles ; and of taste to the tongue.

The pneumogastric or **vagus** : *Origin.*—Lateral tract behind olivary body.

Course.—From origin to jugular foramen, through which it passes with spinal accessory ; in the foramen it presents the ganglion of the root, to which the accessory part of the spinal accessory nerve is joined; upon it leaving the foramen there is seen the ganglion of the trunk. Issuing from the skull, the nerve passes down the neck in the carotid sheath, and between the artery and vein to the root of the neck; there the course on each side of the body becomes different.

The *right* nerve passes between subclavian artery and vein, and down by side of trachea to posterior part of the root of the lung, forming the posterior pulmonary plexus; thence proceed two cords, which run down on the œsophagus, communicate with nerve of opposite side (œsophageal plexus), join below into one trunk, which is distributed to the posterior surface of the stomach.

The *left* nerve passes between the subclavian artery and vein, and behind the left innominate vein, thence over arch of aorta to back part of root of left lung, anterior surface of œsophagus, to anterior surface of stomach.

Connecting Branches.

The ganglion of the root is connected to the spinal accessory, petrous ganglion of the glosso-pharyngeal, facial and sympathetic nerves.

The ganglion of the trunk communicates with the hypoglossal sympathetic, and loop between 1st and 2nd cervical nerves.

Branches.

Auricular (Arnold's): from the ganglion of the root, communicates with facial and its auricular branch, supplies back of pinna.

Pharyngeal: from the ganglion of the trunk, passes in front or behind internal carotid artery to upper part of middle constrictor, where it joins pharyngeal plexus.

Superior laryngeal: from the ganglion of the trunk, passes down behind internal carotid artery, where it gives off the *external laryngeal nerve*, which supplies the crico-thyroid muscle; thence the trunk passes to thyro-hyoid membrane, and is distributed to the mucous membrane of the larynx and the arytenoid muscle.

Inferior or *recurrent laryngeal:* the *right* nerve arises in front of subclavian artery, winds back round it, and passes up behind common carotid and inferior thyroid arteries to side of trachea. The *left* nerve arises from front of arch of aorta, round which it winds and passes up by side of trachea. Both nerves ascend in a groove between trachea and œsophagus, and enter larynx by piercing inferior constrictor muscle. The nerve supplies all the muscles of the larynx, except the crico-thyroid.

Cervical cardiac (2 or 3): upper branches are small. Inferior, one on either side, arise just above 1st rib; the *right* one passes in front of innominate artery, the *left* one descends in front of the arch of the aorta.

Thoracic cardiac: right ones from the trunk of the nerve, end in deep cardiac plexus. *Left* ones arise from left recurrent laryngeal.

Anterior pulmonary (2 or 3): to anterior part of root of lung.

Posterior pulmonary: numerous, to posterior part of root of lung.

Œsophageal: to œsophagus, forming a plexus.

Gastric: the *right* nerve is distributed to posterior part of stomach and ends in the solar and splenic plexuses. The *left* supplies the anterior surface and ends in the hepatic plexus.

THE SPINAL ACCESSORY NERVE: *Origin.*—The *accessory* part from the lateral tract, the *spinal* part from the side of the cord as low down as the 6th cervical nerve.

Course.—The *accessory* part joins in the jugular foramen the ganglion of the root of the vagus. The *spinal* part enters skull through foramen magnum and passes to jugular foramen; it is enclosed in the same sheath of dura mater as the vagus. Issuing from the foramen, it passes downwards and backwards behind internal jugular vein to upper part of sterno-mastoid, which it pierces, and crossing the occipital part of the posterior triangle, enters the under surface of the trapezius.

Distribution.—Supplies sterno-mastoid and trapezius muscles.

9th or hypoglossal nerve : *Origin.*—From the groove between the olivary and pyramidal bodies.

Course.—The nerve passes through anterior condyloid foramen, then downwards between internal carotid artery and internal jugular vein to a level of the angle of the jaw; curving round the occipital artery, it crosses the external carotid artery and passes between the mylo-hyoid and hyoglossus muscles; entering the genio-hyo-glossus, it is continued forward to the tip of the tongue.

Branches.

Communicating: pneumogastric, sympathetic; loop between 1st and 2nd cervical and gustatory.

Distributing.

Descendens noni: a slender branch given off as the nerve hooks round occipital artery, passes down over carotid sheath, joining in a loop with 2nd and 3rd cervical (communicans noni); from this loop muscular branches to sterno-hyoid, sterno-thyroid, and the two bellies of the omo-hyoid are given off.

Thyroid-hyoid: passes round great cornu of hyoid bone to supply thyro-hyoideus.

Muscular: to stylo-glossus, hyo-glossus, genio-hyoid, genio-hyo-glossus.

SPINAL NERVES.

There are 31 pairs, *viz.:* 8 cervical, 12 dorsal, 5 lumbar, 5 sacral, and 1 coccygeal. Each nerve arises from the spinal cord by an anterior (motor) and a posterior (sensory) root; the latter having a ganglion developed upon it.

CERVICAL: increase in size from 1st to 5th. The 1st or *sub-occipital* leaves between the occiput and atlas, the 8th between the last cervical and 1st dorsal vertebra.

THE CERVICAL PLEXUS: formed by the anterior branches of the first four cervical nerves.

Superficial Branches.

Superficial cervical : from 2nd and 3rd; passes forwards beneath external jugular vein to side and front of neck. *Ascending branch* accompanies external jugular vein. *Descending* supply integument as low as sternum.

Great auricular : from 2nd and 3rd. Winds round margin of sterno-mastoid to reach parotid gland. *Facial*, to integument of face. *Auricular*, to back part of pinna. *Mastoid*, joining with posterior auricular of facial.

Small occipital : from 2nd, ascends posterior border of sterno-mastoid to head, supplies integument and muscle of side of head. *Auricular* supplies attollens aurem.

Supra-clavicular : from 3rd and 4th. *Sternal*, to integument as far as middle line. *Clavicular*, to integument over pectoral muscle. *Acromial*, to integument of shoulder.

Deep Branches (Internal).

Communicating : from loop between 1st and 2nd, joins sympathetic, hypoglossal, pneumogastric, and spinal accessory nerves.

Muscular : from 1st to rectus anticus and lateralis muscles.

Communicans noni : from 2nd and 3rd, form a loop with descendens noni in front of carotid vessels.

Phrenic : from 3rd and 4th, and occasionally from the 5th; lies in front of scalenus anticus and descends on it in front of subclavian artery to enter the chest, having crossed the internal mammary artery at origin. In the thorax it descends in front of the root of the lung, being between the pericardium and pleura below, to the diaphragm, which it perforates, and is distributed to its abdominal surface. The *right* nerve lies outside right innominate vein and superior vena cava. The *left* nerve crosses the arch of the aorta and is longer than the right. Filaments from each supply the pericardium and pleura.

Deep Branches (External).

Communicating : to spinal accessory in sterno-mastoid muscle.

Muscular : to sterno-mastoid, levator anguli scapulæ, scalenus medius, and trapezius.

Posterior Branches.

External : supply cervicalis ascendens, transversalis colli, and trachelo-mastoid.

Internal : *Sub-occipital:* from the 1st, lies behind vertebral artery, enters sub-occipital triangle, supplying the recti, obliqui, and complexus muscles.

Great occipital: from 2nd, supplies inferior oblique and communicates with the sub-occipital. It pierces the complexus and trapezius near occiput and ascends on the skull with the vertebral artery to supply the integument.

Posterior branch of the 3rd: pierces trapezius to supply integument at base of occiput.

NERVES OF THE UPPER EXTREMITY.

THE BRACHIAL PLEXUS : formed by the anterior root of the lower four cervical and 1st dorsal nerves. The plexus divides into branches for the upper limb opposite the coracoid process. The 5th and 6th join outside the scalenus anticus, receiving the 7th nerve, forming the outer cord. The last cervical and 1st dorsal unite and form the inner cord, between the two scaleni muscles. Each nerve also sends a branch, which together form the posterior cord just opposite the clavicle. The cords are placed one internally, one externally, and the other posteriorly to the axillary artery.

Branches above the Clavicle.

Muscular : to longus colli, scaleni, rhomboidei, and subclavius.

Communicating : from the 5th to the phrenic.

Posterior thoracic : from 5th and 6th, descends behind plexus to nearly lower border of serratus magnus, which it supplies.

Supra-scapular : from outer cord, passes beneath trapezius to upper border of scapula, enters supra-spinous fossa through supra-scapular notch ; here it gives two branches to the supra-spinatus, and an articular to the joint; thence it passes to the infra-spinous fossa and ends in the infra-spinatus.

Branches below the Clavicle.

The several nerves are given off as follows:

Outer cord.	*Inner cord.*	*Posterior cord.*
Ext. anterior thoracic.	Int. anterior thoracic.	Subscapular.
Musculo-cutaneous.	Nerve of Wrisberg.	Circumflex.
Outer hd. of median.	Internal cutaneous.	Musculo-spiral.
	Ulnar.	
	Inner hd. of median.	

External anterior thoracic (outer cord): crosses over axillary artery to pectoralis major.

Internal anterior thoracic (inner cord): passes between axillary artery and vein to two pectoral muscles.

Subscapular: three, from posterior cord.

Upper: the smallest perforates upper part of subscapularis.

Lower: supplies the teres major.

Long: runs along lower border of subscapularis to supply the latissimus dorsi.

Circumflex (posterior cord): passes behind artery through quadrilateral space formed by teres major, scapula, long head of the triceps and humerus, and divides into:

Upper branch: winds round humerus, supplying deltoid and skin.

Lower branch: gives a branch to teres minor, which has a gangliform swelling upon it; also branches to deltoid and integument.

Internal cutaneous (inner cord): lies on inner side of artery, becomes cutaneous about middle of arm, and divides into two branches:

Anterior: passes behind median basilic vein, supplies front of inner side of forearm as low as wrist.

Posterior: winds over internal condyle, supplying the back of inner side of forearm to about the middle.

Lesser internal cutaneous (nerve of Wrisberg): lies to inner side of axillary vein, communicates with the intercosto-humeral and then descends along inner side of brachial vessels to middle of the arm, where it becomes cutaneous and supplies integument of inner side as far as inner condyle.

Musculo-cutaneous (outer cord): perforates coraco-brachialis, passing to outside of arm between biceps and brachialis anticus, supplying those three muscles, filaments also are given to the elbow-joint; becomes cutaneous just above elbow, and passing *behind* median cephalic vein, divides into :—

Anterior: along radial border of forearm, supplying ball of thumb and joining the radial.

Posterior: supplies integument of lower 3rd of back of forearm on the radial side, joins branches of radial and musculo-spiral (external cutaneous branch).

Median: arises by two roots, one from the outer cord, the other from the inner cord of the plexus. At first the nerve lies to the outer side of the axillary artery, but about the middle of the arm it crosses the brachial artery to reach the inner side; it then passes between the two heads of the pronator teres, and is continued straight down to 2 in. above the wrist beneath the flexor sublimis; there it lies between the tendons of the flexor sublimis and flexor carpi radialis. Passing beneath the annular ligament it becomes somewhat flattened, and divides into two parts for supplying the outer 3½ fingers.

Branches in the Forearm.

Muscular: to all superficial muscles in front of forearm except flexor carpi ulnaris.

Anterior interosseous: passes with the anterior interosseous artery on the membrane between the flexor profundus and flexor pollicis to end in the pronator quadratus. Supplies all the deep muscles except inner half of flexor profundus.

Palmar cutaneous: pierces fascia just above annular ligament, ends in the integument of the palm, joining the palmar cutaneous of the ulnar nerve.

Branches in the Hand.

Muscular to thumb: supplies adductor, opponens, and outer head of flexor brevis pollicis.

Digital: five in number, supplying outer 3½ fingers. 1st and 2nd supply the thumb, 3rd to radial side of index finger and supplies 1st lumbricalis; 4th supplies 2nd lumbricalis and adjacent side of index and middle fingers; 5th supplies adjacent sides of ring and middle fingers, and joins a branch of the ulnar.

Ulnar (inner cord): passes down the inner side of artery to middle of arm; it then passes with inferior profunda artery through internal intermuscular septum to groove between olecranon and internal condyle. Thence it passes through the two heads of the flexor carpi ulnaris and descends under cover of that muscle along ulnar side of forearm and internal to ulnar artery as far as the pisiform bone; goes over annular ligament outside that bone, and divides into superficial and deep palmar branches.

Branches in the Forearm.

Articular: to elbow and wrist joints.

Muscular; to flexor carpi ulnaris and inner half of flexor sublimis.

Cutaneous; arises near middle of forearm, and divides into: superficial to integument, deep, accompanies ulnar artery to hand, and supplies palm, joining cutaneous of median.

Dorsal cutaneous; comes off about 2 inches above wrist, winds round ulna beneath flexor carpi ulnaris, supplies inner side of little finger, and adjacent sides of ring and little fingers.

Palmar Branches.

Superficial; supplies palmaris brevis and inner 1½ fingers, communicating with the median.

Deep: accompanies deep palmar arch; it supplies the small muscles of the 5th finger, and gives two branches to each interosseous space, one for each set of interossei; branches are also given to the two inner lumbrical muscles.

In the space between the thumb and index finger the nerve ends by supplying the abductor and inner head of the flexor brevis pollicis.

Musculo-spiral (posterior cord) : winds round in the musculo-spiral groove with superior profunda artery to the outer side of arm. Piercing the external intermuscular septum, it passes to the external condyle between the supinator longus and brachialis anticus, where it divides into radial and posterior interosseous nerves.

Branches.

Muscular: to triceps, anconeus, supinator longus, extensor radialis longior, brachialis anticus.

Cutaneous: Internal, comes off near axilla, supplies integument on back of arm to near olecranon. *External* (2), upper one perforates outer head of triceps, accompanies cephalic vein to elbow, supplying the integument of the lower half of arm in front. Lower one supplies integument of lower part of arm, and back part of radial side of forearm as far as the wrist.

Radial: passes down by outer side of radial artery, under cover of the supinator longus, till within 3 inches of the end of the radius, where the nerve passes backwards beneath the tendon, and piercing the fascia on outer side of forearm divides into two branches :—

External: supplies ball and outer border of thumb, and joining external cutaneous nerve.

Internal: joins a branch of the external cutaneous and dorsal of ulnar. It gives off four digital nerves, thus : 1st to inner side of thumb, 2nd to outer side of index, 3rd to adjacent sides of index and middle, 4th to adjacent sides of middle and ring fingers. It thus corresponds in its distribution with the median nerve.

Posterior interosseous: passes to back of forearm by piercing the supinator brevis ; there it passes between the superficial and deep layers of muscles to about middle of forearm, where it reaches the interosseous membrane, on which it lies, extending down to the wrist, where it ends in a gangliform enlargement, from which there are given off filament to the ligaments, &c. Supplies all the supinators, extensors of carpus and fingers *except* supinator longus and extensor carpi radialis longior.

NERVES OF THE BODY.

DORSAL: twelve in number. The 1st comes from between the 1st and 2nd dorsal and joins the brachial plexus, the last from between the 12th dorsal and 1st lumbar vertebræ. Each nerve at its exit from the intervertebral foramina divides into an anterior and posterior branch. The 1st and 12th nerves, however, require a separate description.

The POSTERIOR or *dorsal* branches pass between the transverse processes and divide into external and internal branches to supply the muscles of the back. *Cutaneous* branches are derived from each of these sets, the six upper ones coming from the internal branches and the six lower ones from the external branches.

The ANTERIOR branches, or *intercostal nerves*, are twelve in number on each side, joining with the sympathetic.

The UPPER six pass forwards in the intercostal spaces below the vessels, between the pleura and external intercostal muscle, then between the external and internal intercostal muscles, and extend forwards to the sternum, to end as the anterior cutaneous nerves of the thorax.

Branches.

Lateral cutaneous: given off midway between head of rib and sternum, the 1st nerve not generally having one; each branch, except that from the 2nd nerve, then divides into anterior and posterior branches, which supply the muscles, gland, &c.

The lateral cutaneous branch of the 2nd nerve, or *intercosto-humeral*, has no anterior branch; the posterior branch crosses the axilla and joins the nerve of Wrisberg, and supplies the integument of the inner side of the arm.

The LOWER six pass like the upper ones to the front of the intercostal spaces, thence between the internal oblique and transversalis to the sheath of the rectus, which they perforate, and terminate near the middle line as anterior cutaneous branches.

Branches.

Lateral cutaneous: supply the integument of the abdomen, having anterior and posterior branches.

PECULIAR DORSAL NERVES: *The 1st nerve:* its *anterior* branch is mostly consumed in the brachial plexus, but a small branch is given off to the 1st intercostal space, which has no lateral cutaneous branch. *The 12th nerve* does not lie in an intercostal space, but below the 12th rib is remarkable for the large size of its lateral cutaneous branch.

LUMBAR: five on each side. The ANTERIOR branches increase in size from above down, and near their origin communicate with the sympathetic, the upper four forming the lumbar plexus; that of the five joins with the 1st sacral to form the *lumbo-sacral* cord. The POSTERIOR branches pass between the transverse processes and divide into internal and external branches to supply the muscles and integument.

NERVES OF THE LOWER EXTREMITY.

LUMBAR PLEXUS: formed by the communications of the anterior roots of the four upper dorsal nerves.

Ilio-hypogastric: from 1st lumbar, appears at upper part of outer border of psoas, crosses to iliac crest, piercing transversalis, to divide into:

Iliac branch: to integument of buttock.

Hypogastric branch: to integument of umbilical region.

Ilio-inguinal: from 1st lumbar; passes over quadratus lumborum and iliacus to iliac crest, to pierce the transversalis and internal oblique; it then accompanies the cord through canal and external ring, and is distributed integument of groin and the scrotum.

Genito-crural: from 2nd lumbar, with a branch from 1st. Passes on the psoas to Poupart's ligament to divide into:

Genital branch: accompanies spermatic cord, and supplies the cremaster muscle.

Crural branch: supplies integument of upper and front of thigh.

External cutaneous: from 2nd lumbar; perforates middle of outer border of psoas, and passes between two anterior iliac spines, where it divides into:

Anterior branch: supplies outer part of anterior surface of thigh.

Posterior branch: supplies outer part of posterior surface of thigh to the middle.

Obturator: from 3rd and 4th lumbar; passes from inner border of psoas, near brim of pelvis above obturator artery, to canal in upper part of thyroid foramen. *In this canal* it divides into:

Anterior or superficial part: descends in front of adductor brevis, behind pectineus and adductor longus; it supplies the hip-joint, gracilis adductor longus, adductor brevis, femoral artery, and a branch to plexus near sartorius.

Posterior or deep part: passes through obturator externus and behind adductor brevis; it supplies obturator externus, adductores longus et brevis, and a branch along popliteal artery to knee-joint.

Accessory obturator: from 3rd and 4th lumbar or from obturator trunk; when present it supplies pectineus and hip-joint.

Anterior crural: from 3rd and 4th lumbar; emerges from lower part of outer border of psoas and descends between that muscle and the iliacus; on the outer side of the iliac vessels it supplies the iliacus and femoral artery whilst in the pelvis, and on emerging from it beneath Poupart's ligament; it divides into:

ANTERIOR OR SUPERFICIAL PORTION, which gives off:

Middle cutaneous: pierces fascia 3 in. below Poupart's ligament, dividing into two branches to supply the integument to the knee; supplies also the sartorius.

Internal cutaneous; passes obliquely across to inner side of femoral artery and divides into: *Anterior branch:* supplies integument of the lower 3rd of inner side of thigh. *Inner branch:* pass down posterior border of Sartorius to knee, giving branches to plexus near that muscle, and finally is distributed to integument of the leg.

Internal saphenous: accompanies femoral vessels as far as opening in adductor magnus, where it passes inwards beneath sartorius. Thence it is continued with the internal saphenous vein along inner side of leg behind inner border of tibia; at lower 3rd of thigh it divides into two branches, one passes to inner ankle along border of tibia, the other goes in front of ankle and is distributed on inner side of foot as far as great toe. In its course it gives off a branch to patellar plexus, and below the knee to the integument on the anterior and inner surfaces of the leg.

Plexus patellæ: the patellar plexus is formed by communications between the anterior branch of the internal cutaneous, branches of the long saphenous, branch of the middle and external cutaneous nerves, together with the patellar branch of the internal or long saphenous nerve.

DEEP OF POSTERIOR PARTS are:

Muscular to pectineus, generally two, which pass behind femoral artery: to the rectus, to the vastus externus, which gives an articular branch to the knee-joint, to the vastus internus, which gives off an *articular* branch to the knee-joint, accompanying the deep branch of the anastomotica magna artery.

SACRAL NERVE: five in number; upper four pass through anterior sacral foramina, the 5th through the sacro-coccygeal foramen. The roots of origin form the *cauda equina;* and each nerve divides into anterior and posterior branches.

The *posterior* branches of the upper three nerves divide into internal and external branches, the former supplying the multifidus spinæ; the latter the integument over sacrum, coccyx, and posterior gluteal region; the two lower nerves supply filaments to integument over coccyx, the 5th communicating with the coccygeal.

The *anterior* branches of the upper four communicate with the sympathetic, supplying rectum bladder and pelvic viscera and the anal muscles; that of the 5th supplies the coccygeus.

COCCYGEAL NERVE: this nerve divides into an anterior branch, which pierces sacro-sciatic ligament and coccygeus, and supplies integument over coccyx: and a posterior, to supply coccygeal integument.

SACRAL PLEXUS: is formed by the lumbo-sacral cord and the anterior branches of the upper three, and part of the 4th sacral nerves; these lie upon the pyriformis and there unite in one flat band, which passes through the great sacro-sciatic notch, just above the small ligament; in the pelvis the plexus is separated from the sciatic and pudic arteries by the pelvic fascia.

Branches given off in the Pelvis.

Muscular: to *pyriformis*, two in number; to *obturator internus*, coming from point of union of lumbo-sacral and 1st sacral nerve; passes with pudic nerve through sacro-sciatic foramen to enter inner surface of muscle, supplying on its way the *superior gemellus:* to the *quadratus femoris*, passes out under cover of great sciatic; supplies also the *inferior gemellus*.

Superior gluteal: from lumbo-sacral cord, passes out great sacro-sciatic foramen, above the pyriformis, with the gluteal vessels; divides into a *superior* branch, which supplies the two smaller glutei, and *inferior* branch distributed to the tensor vaginæ femoris.

Pudic: comes off from lower part of plexus, passes out of great sacro-sciatic notch, winds over ischial spine, and re-enters pelvis through the small notch; it then enters a sheath of the obturator fascia in the outer wall of the ischio-rectal fossa, with accompanying vessels, and divides into its two terminal branches.

Branches.

Inferior hæmorrhoidal: supplies external sphincter, skin of anus; communicates with superficial perineal nerves.

Perineal: largest terminal branch, accompanies perineal artery and divides into superficial and muscular branches. The *Superficial perineal* branches are two, anterior and posterior; the former passes with superficial perineal artery either under or over the transversus perinæi to supply the scrotum; the latter gives a branch to the anus, and piercing the deep layer of the superficial fascia supplies the scrotum, joining the inferior pudendal. The *muscular* branches supply transversus perinæi, erector penis, compressor urethræ, and accelerator urinæ.

Dorsal nerve of the penis: accompanies pudic artery between the layers of the deep perinæal fascia, and through the suspensory ligament to dorsum of penis, along which it runs as far as the glans, gives off many branches to supply the organ, and joins branches of the sympathetic. In the female this nerve is distributed to the clitoris.

Small sciatic: a cutaneous nerve to lower part of buttock and back of thigh, supplying a muscular branch to the gluteus maximus; it is formed by two branches from the lower part of the plexus; it passes below the pyriformis with the sciatic artery, and beneath the gluteus maximus; at the lower border of that muscle it is overlaid by the fascia lata, which it pierces in the popliteal space.

Branches.

Inferior gluteal: to gluteus maximus.

Internal cutaneous: to integument of upper and inner side of thigh; one larger one, the *inferior pudendal*, supplies scrotum and joins a superficial perineal.

External cutaneous: wind round gluteus maximus, supply the integument over lower part of buttock.

Terminal: to integument of thigh, popliteal region, and calf of leg.

GREAT SCIATIC: the largest nerve in the body, and is the continuation of the lower part of the sacral plexus; passes out pelvis below the pyriformis and between the tuber ischii and great trochanter, resting upon the gemelli, &c., running with small sciatic nerve and sciatic artery, the latter supplying a branch to its substance. Somewhere between the sacral plexus and lower part of the thigh, but generally about the middle, the nerve bifurcates into external and internal popliteal.

Branches of the Trunk.
Articular: to hip-joint.
Muscular: given off under biceps to semi-membranous, semi-tendinosus, biceps, and adductor magnus.

INTERNAL POPLITEAL: larger terminal branch, passes along middle of popliteal space to lower border of popliteus, where it gets the name of *posterior tibial*; it is at first superficial to and outside the artery, but at the bottom of the space it crosses to the inner side.

Branches.
Articular (3): two accompany the internal articular arteries, the 3rd the azygos.
Muscular: to the *gastrocnemius*, one for each head; the outer one supplying also the *plantaris*. To the *soleus* and to the *popliteus*; the nerve to the latter turns round lower border of muscle and enters it upon its anterior surface.
External or **short saphenous**: passes down leg between two heads of the gastrocnemius, pierces the deep fascia about middle of leg, and there joins the *communicating peroneal*; it then follows the course of the external saphenous vein, round outer malleolus, and supplies integument of outer side of foot and little toe, communicating with the musculo-cutaneous on the dorsum.

POSTERIOR TIBIAL (branch of internal popliteal): begins at the lower border of the popliteus, and runs with the posterior tibial vessels to interval between the external malleolus and heel, where it divides into external and internal plantar. It is at first inside the artery but afterwards gets to the outer side.

Branches.

Muscular : to tibialis posticus, flexor longus digitorum, and flexor longus pollicis, the latter accompanying the peroneal artery.

Plantar cutaneous : pierces internal annular ligament to supply integument of heel and inner side of sole of foot.

Internal plantar : largest terminal branch ; accompanies artery along inner side of foot : the larger nerve thus accompanies the smaller artery ; corresponds to median of hand. It passes between the abductor pollicis and flexor brevis digitorum to divide opposite the bases of the metatarsal bones into four branches, the outermost of which communicates with the external plantar.

Branches.

Cutaneous : to sole of foot.

Muscular : to abductor pollicis and flexor brevis digitorum.

Articular : to tarsal and metatarsal articulations.

Digital (4) : the 1st supplies inner border of 1st toe and the flexor brevis pollicis, the 2nd supplies the opposite sides of the 1st and 2nd toes and the 1st lumbricalis, the 3rd supplies the opposite sides of the 2nd and 3rd toes and the 2nd lumbricalis, the 4th supplies the adjacent sides of the 3rd and 4th toes and joins the external plantar.

External plantar : passes across to outer side of foot with artery, supplying on its way the abductor minimi digiti and accessorius ; at the outer border of the latter muscle it divides into :

Superficial : which divides into two digital nerves, one supplying the outer side of the little toe, the flexor brevis minimi digiti, and the two interossei of the 4th space : the other supplies the adjacent sides of the 4th and 5th toes and communicates with the internal plantar.

Deep or muscular : accompanies deep part of artery, supplying the adductor pollicis, transversus pedis, two outer lumbricales, interossei of inner three spaces.

EXTERNAL POPLITEAL or peroneal : passes across the popliteal space to the fibula; 1 inch below head of that bone it pierces the peroneus longus, and in that muscle divides into anterior tibial and musculo-cutaneous nerves.

Branches.

Articular (2): accompany superior and inferior external articular arteries; a recurrent branch also accompanies the recurrent anterior tibial artery.

Cutaneous (2 or 3): supply integument of back and outer side of leg as far as lower 3rd.

Communicating peroneal: arises close to head of fibula and joins the short saphenous. *V.* Short saphenous.

Anterior tibial: passes to front of interosseous membrane, reaching outer side of anterior tibial artery, with which it descends to the ankle-joint, where it bifurcates into an internal and external branch.

Branches.

Muscular: to tibialis anticus, extensor longus digitorum, peroneus tertius, and extensor proprius pollicis.

External or *tarsal:* passes outwards beneath the extensor brevis digitorum and becomes ganglionic, supplies the extensor brevis, with the articulations of the tarsus and metatarsus.

Internal: accompanies dorsal artery to 1st interosseous space, supplying opposite sides of 1st and 2nd toes, communicating with the musculo-cutaneous.

Musculo-cutaneous: supplies fibular muscles and dorsal integument of foot, passes between peronei and the extensor of toes, piercing deep fascia at lower ⅓ of leg.

Branches.

Muscular: to peroneus longus and peroneus brevis.

Cutaneous:

Internal: passes over ankle to inner side of 1st toe and adjacent sides of 2nd and 3rd toes, *communicates* with internal saphenous and anterior tibial nerves.

External: supplies adjoining sides of 3rd, 4th, and 5th oes; *communicates* with short saphenous.

THE ORGANS OF DIGESTION.

THE PALATE.

The palate forms the roof of the mouth, and consists of two parts, *hard* and *soft*.

The hard palate consists of the palatal processes of the superior maxilla, together with mucous membrane and periosteum lining them.

The soft palate, consisting of muscles, aponeurosis, vessels, nerves, &c., enclosed in a layer of mucous membrane, is attached in front to the posterior margin of the hard palate, and the sides blend with the pharynx; from the middle of the posterior edge there hangs the *uvula*, and from the bases of this arch, on each side there are two folds of mucous membrane, &c., the *pillars*, anterior and posterior, between which the *tonsil* lies.

THE SALIVARY GLANDS.

The parotid is the largest, and lies below and in front of the external ear, being limited above by the zygoma, below by the angle of the lower jaw, and a line drawn horizontally from this point to the mastoid process. The external carotid artery is imbedded in it, and the facial nerve crosses it transversely. The *duct* (Steno's) is 2½ in. in length, and opens into the mouth opposite the upper 2nd molar tooth. The *Socia parotidis* is a separate lobe lying under the zygomatic arch.

The submaxillary is placed under the lower jaw, lying upon the mylohoid, stylohyoid, and hyoglossus muscles, and separated from the parotid by the stylo-maxillary ligament. The facial artery is imbedded in a groove on the posterior surface. The *duct* (Wharton's) opens at the summit of a papilla by the side of the frænum linguæ.

The sublingual is placed under the mucous membrane at the floor of the mouth. It is almond-shaped, and its *ducts*

(18 to 20) open separately on the floor of the mouth; generally one or two go to join Wharton's duct.

THE PHARYNX.

The pharynx is situated behind the nose, the mouth, and the larynx, and extends from the base of the skull to the cricoid cartilage in front, and the 5th cervical vertebra behind.

Openings.—The *posterior nares* (2), placed in the upper part of the anterior wall. *Eustachian tubes* (2), open one on each side at the upper part. The *mouth*, situated just below the posterior nares. The *laryngeal* and *œsophageal.*

THE ŒSOPHAGUS.

The œsophagus extends from pharynx to stomach, and is 9 inches long. It begins at the lower border of cricoid and passes through the posterior mediastinum and the diaphragm to the cardiac orifice of the stomach opposite the 9th dorsal vertebra.

Relations in the neck.

In front. The trachea, thyroid gland, and thoracic duct.

Behind. Vertebral column and longus colli.

Laterally. Common carotid artery, the thyroid gland, recurrent laryngeal nerves.

In the thorax.

In front. Trachea, arch of aorta, left carotid and left subclavian arteries, left bronchus, pericardium, left pneumogastric.

Behind. Vertebræ, longus colli, intercostal vessels, aorta, right pneumogastric.

Laterally. Pleuræ, venæ azygos major on the right, and descending aorta.

THE STOMACH.

Form.—Conical, with base or fundus to left side; the upper border concave, and called *lesser* curvature: lower, convex, named *greater* curvature.

Position.—Occupies left hypochondriac and epigastric regions.

Orifices.—*Cardiac*, at the left end communicating with the œsophagus; *pyloric*, at the right extremity passing into the duodenum.

Dimensions.—10 to 12 inches long; 4 to 5 inches in diameter at widest part.

Connections.

Left or *cardiac end:* fixed by œsophagus to diaphragm, lying beneath the ribs and connected with the spleen by the gastrosplenic omentum.

Right or *pyloric end:* reaches gall bladder, touching under part of left lobe of liver.

Anterior surface is in contact with, from left to right, diaphragm, abdominal parietes (epigastric region), under surface of left lobe of liver.

Posterior surface is connected with pancreas, crura of diaphragm, aorta, vena cava, solar plexus.

Superior border: attached to liver by small omentum.

Inferior border: gives attachment to great omentum.

ARTERIES.—*Coronary* and *superior pyloric* run along lesser curvature. *Right* and *left gastro-epiploic* along inferior or greater curvature. *Vasa brevia* from the splenic to fundus.

NERVES.—*Right pneumo-gastric* to posterior surface. *Left pneumogastric* to anterior surface.

THE SMALL INTESTINES.

THE DUODENUM.

Length.—8 to 10 inches.

Shape.—Horse-shoe, with the convexity to the right side, the concavity enclosing the head of the pancreas.

Position.—Occupies right hypochondriac and epigastric regions.

Has no mesentery, and only partially invested by peritoneum.

Divided into three parts: superior transverse, vertical and inferior transverse.

Connections.

Superior transverse part: 2 inches long; directed from pylorus to gall-bladder.

In front. Liver, gall-bladder.

Behind. Bile duct, vena porta, hepatic artery.

Vertical part: 3 inches long, passes from gall-bladder down to 3rd lumbar vertebra. Ducts of liver and pancreas enter this part.

In front. Hepatic flexure of colon.

Behind. Right kidney.

Inner side. Head of pancreas, common bile duct.

Inferior transverse part: about 5 inches long; passes across spine, ascending from 3rd to 2nd lumbar vertebra, ends in jejunum on left side of spinal column, lying between layers of transverse meso-colon.

In front. Superior mesenteric vessels and plexus of nerves.

Behind. Aorta, vena cava, crura of diaphragm.

Above. Pancreas.

ARTERIES.—Pyloric and pancreatico-duodenal of hepatic, inferior pancreatico-duodenal of superior mesenteric.

NERVES from solar plexus.

THE JEJUNUM.

The jejunum occupies $\frac{2}{5}$ of the rest of the small intestines; commencing on the left side of the 2nd lumbar vertebra, it terminates in the ileum; it is wider, coats thicker, more vascular, and of a deeper colour than the ileum.

THE ILEUM.

The ileum consists of the remaining $\frac{3}{5}$ of the small intestines, and terminates in the right iliac fossa by opening into the caecum.

The following will serve to distinguish the three parts of the small intestines :

Duodenum.	*Jejunum.*	*Ileum.*
The largest part.	More vascular than ileum.	Villi, small.
Thickest coats.	Valvulæ conniventes.	Valvulæ conniventes, not present or only slightly.
Brunner's glands.	Villi, well marked.	Peyer's patches.
Valvulæ conniventes.		
No mesentery.		

THE LARGE INTESTINE.

Extent.—From the ileum to the anus.

Characteristics.—Larger size and more fixed than the small intestine, and sacculated.

The cæcum is a dilated pouch in which the large intestine commences, situated in the right iliac fossa and well bound down by peritoneum ; at the lower end and back part is the *appendix vermiformis*, a blind tubular projection.

The *ileo-cæcal valve* is formed by the ileum passing through the wall of the cæcum. The upper fold is horizontal and called the ileo-colic. The lower is vertical and termed the ileo-cæcal. The ridge on either side is called the *frænum.*

The COLON is divided into ascending, transverse, descending, and sigmoid flexure.

The ascending colon extends from the cæcum to the under surface, liver to the right of the gall-bladder, where it ~~turns to the left,~~ forming the *hepatic flexure.* The peritoneum covers the anterior and lateral surfaces.

Relations.—*In front.* The convolutions of the ileum.

Behind. Quadratus lumborum, right kidney.

The transverse colon passes from right to left from the gall bladder to the spleen. It forms an arch convex anteriorly : *the transverse arch of colon.* It is surrounded by peritoneum, which is attached to the spine by the meso-colon.

Relations.—Above. Liver, gall-bladder, stomach, lower end of spleen.

Below.—Small intestines.

Anteriorly. Anterior layers of great omentum, parietes.

Posteriorly. Transverse meso-colon.

The descending colon passes from the spleen to the left iliac fossa, ending in the sigmoid flexure. The peritoneum invests its anterior and lateral surfaces.

Relations.—Behind. Left crus, left kidney, quadratus lumborum.

The sigmoid flexure is placed in the left iliac fossa; it commences at the margin of the crista ilii, curves like an S, and ends in the rectum opposite the left sacro-iliac articulation.

THE RECTUM extends from the sigmoid flexure to the anus. It is not sacculated, like the rest of the large intestine. It is divided into three parts:

The 1st part.

Extent.—From the left sacro-iliac articulation to the middle of the 3rd piece of the sacrum.

Relations.—Completely surrounded by peritoneum and attached to the sacrum by meso-rectum.

Behind. Pyriformis, sacral plexus, branohes of left internal iliac artery.

In front. Posterior surface of the bladder (male), posterior surface of uterus (female).

The 2nd part.

Extent.—From the ending of the 1st part to the tip of the coccyx.

Relations.—It has peritoneum on the upper part of anterior surface only.

In front. Triangular part at base of bladder, vesiculæ seminales, vasa deferentia, under surface of prostate (male), posterior wall of vagina (female).

Laterally. Coccygeus.

The 3rd part.

Extent.—From the tip of the coccyx to anus.

Relation.—Has no peritoneum.

In front. Fore part of prostate, membranous part of the urethra, bulb of corpus spongiosum.

Laterally and behind. Levatores ani.

THE LIVER.

Situation.—Right hypochondriac and epigastric regions.

Average weight.—Three to four pounds.

Upper surface. Convex, covered by peritoneum; above is the diaphragm. It is divided into two unequal parts by a fold of peritoneum, called the *suspensory* or *broad ligament.*

Under surface. Concave, and is connected with the stomach, duodenum, hepatic flexure, right kidney, and supra-renal body.

Posterior border. Connected to diaphragm by the coronary ligament; is broad and round.

Anterior border. Sharp and free, and marked by a notch opposite attachment of suspensory ligament.

The Ligaments are five in number; four are composed of peritoneum and are:

The suspensory, falciform, or **broad** ligament is sickle-shaped, with the base forward. It is attached above to the diaphragm, extending on to the sheath of rectus as far as the umbilicus, and below from the notch in front to the posterior edge of the liver. The anterior edge encloses the round ligament.

The lateral ligaments, right and left, extend from the sides of the diaphragm to the posterior border of the liver.

The coronary ligament is continuous with the lateral ligaments, and attaches the posterior margin of the liver to the diaphragm.

The round ligament is the obliterated umbilical vein.

Fissures.

The longitudinal fissure is occupied by the round ligament, and divides the body into right and left lobes; it commences at the notch on the anterior and ends at the posterior edge.

The fissure of the ductus venosus is the posterior half of the longitudinal fissure, and contains a fibrous cord.

The transverse or **portal fissure** is placed at right angles to the longitudinal, and lodges, from before backwards, the hepatic duct, artery, and portal vein.

The fissure for the gall-bladder is parallel to the longitudinal fissure, on the under surface of the right lobe.

The fissure for the vena cava is placed obliquely at the posterior margin of the liver behind the gall-bladder.

Lobes.

Right and left lobes: the right being the larger and containing the three following:—

The lobus quadratus: bounded by the longitudinal and transverse fissures and the gall-bladder.

The lobus Spigelii is the projection between fissures for the vena cava and ductus venosus, behind the transverse fissure.

The lobus caudatus connects the preceding lobe with the main mass of the right lobe.

THE GALL-BLADDER

Is a conical bag placed in a fossa on the under surface of the right lobe of the liver. It is held in position by peritoneum.

Relations.—The body is in relation in front with the liver, the 1st part of duodenum, the pylorus, hepatic flexure of colon. The fundus is in contact with the parietes opposite the 10th costal cartilage.

The Biliary ducts.

The hepatic duct issues from the liver at the transverse fissure, and joins the cystic.

The cystic duct passes from the neck of the gall-bladder to join the preceding.

The ductus communis choledochus or common bile duct is the result of the union of the hepatic and cystic ducts. It passes behind the 1st part of the duodenum, in front of the venæ portæ, and outside the hepatic artery, and passing between the pancreas and 2nd part of the duodenum, enters the small intestine obliquely, a little below the middle of the descending part of the duodenum.

THE PANCREAS.

Length.—Six to eight inches.

Position.—Placed in the epigastric and both hypochondriac regions, directed transversely across posterior wall of abdomen.

Connections.

In front. Ascending transverse meso-colon.

Behind. Aorta, vena cava, crura of diaphragm, splenic vein, commencement of vena portæ, left kidney.

Upper border. From right to left, 1st part of duodenum and hepatic artery, cœliac axis, splenic vessels.

Lower border. From right to left ; 3rd part of duodenum, superior mesenteric vessels, inferior mesenteric vessels.

Left end or tail. Touches spleen.

Right end or head. Embraced by duodenum, partly separated, behind by bile duct, and in front by pancreatico-duodenal arteries.

Duct : extends transversely from left to right, opens into 2nd part of the duodenum.

Arteries: splenic, pancreatico-duodenal of hepatic, superior mesenteric.

Veins: open into splenic and superior mesenteric.

Nerves: splenic plexus.

THE SPLEEN.

Is of an oblong flattened form, situated in the left hypochondriac region. It is covered by peritoneum and connected with the stomach by the gastro-splenic omentum.

Relations.—Externally. Diaphragm, which separates it from the 9th, 10th, and 11th left ribs.

Internally. Cardiac end of stomach, tail of pancreas, left crus, left supra-renal body.

Above. Connected by a suspensory ligament to the diaphragm.

Below. Splenic flexure. *Posterior margin.* Left kidney.

Arteries. Splenic.

Nerves. Branches of right and left semi-lunar ganglia and right pneumogastric nerve.

THE HEART AND PERICARDIUM.

THE PERICARDIUM.

The pericardium is a fibro-serous membrane, containing the heart and the commencement of the great vessels. The *apex* points upwards and surrounds the vessels coming from the heart for two inches. The *base* is fixed to the central tendon of the diaphragm.

In front.	*Behind.*	*Laterally.*
Thymus gland.	Bronchi.	Pleura.
Overlapped by left lung.	Œsophagus.	Phrenic vessels.
	Descending aorta.	Phrenic nerve.

The serous layer of the pericardium surrounds the heart and is continued on to the inner surface of the pericardium.

THE HEART.

Position.—The heart is placed obliquely, the base being directed upwards, backwards, and to the right; the apex downwards, forwards, and to the left. The apex corresponds to a point one inch to the inner side and two inches below the left mamilla.

Divisions.—The heart is divided longitudinally by a septum into two halves, right and left, each of which is subdivided transversely into two cavities. These four divisions are indicated on the heart's surface by grooves. The upper are called the *auricles* and the lower the *ventricles.*

The Circulation.—The right auricle receives venous blood from the vena cava and coronary sinus; thence it passes into the right ventricle, whence it is conveyed to the lungs by the pulmonary artery. After being oxygenised the blood passes into the left auricle by the pulmonary veins; thence it is conveyed into the left ventricle, and from there to the aorta, whence it passes through the body.

The right auricle consists of a principal cavity and an appendix auriculæ.

The principal cavity or *sinus* is of an irregular form.

The appendix auriculæ is a small muscular pouch overlapping the root of the pulmonary artery.

OPENINGS.—*Superior vena cava*, in the upper and front part. *Inferior vena cava*, at the lowest part of the auricle; between the two is the *tubercle of Lower.*

Coronary sinus, opens between the inferior cava and the auriculo-ventricular opening.

Foramina Thebesii, are the mouths of small veins.

VALVES.—*The Eustachian valve* is a semilunar fold between the anterior margin of the inferior vena cava.

The coronary valve protects the opening of the coronary sinus.

REMNANTS OF FŒTAL STRUCTURE.—*Fossa ovalis* is the remains of the foramen ovale on the septum auricularum.

The Annulus ovalis is an elevated margin of the fossa.

The musculi pectinati are prominent muscular columns running over the surface of the appendix auriculæ.

The right ventricle consists of a cavity and funnel-shaped cavity leading to the pulmonary artery. On the wall are projections, *columnæ carneæ*, of which there are three varieties: the first are merely prominent ridges; the second are attached at the ends merely; the third are the *musculi-papillares*, which project forwards, and to which are attached the *chordæ tendineæ*, or cords attached to the auriculo-ventricular valve.

The tricuspid valve, which guards the right auriculo-ventricular opening, consists of three flaps, formed by a reduplication of the endocardium, together with some muscular fibres. The bases of the flaps are attached to a tendinous ring, while to their free ends are attached chordæ tendineæ. The valve prevents regurgitation of blood into the auricle during the heart's contraction.

The opening of the *pulmonary* artery is at the summit of the funnel-shaped cavity, and is guarded by the pulmonary semilunar valves. The semilunar valves are three folds of the lining membrane which guard the orifice of the pulmonary artery. The free margin of each has in its middle a small nodule or *corpus arantii*, and between each valve and the beginning of the pulmonary artery is a dilatation called the pulmonary sinus, or *sinus of Valsalva*. The point corresponding externally to these valves, is the junction of the third left rib cartilage with the sternum.

The left auricle consists of a principal cavity and an appendix auriculæ; the latter looks forwards and to the right side, projecting over the commencement of the pulmonary artery.

OPENINGS.—*The pulmonary veins* (4) open into the cavity, two on either side.

The auriculo-ventricular opening is smaller than that on the right side, as are also the musculi pectinati.

The left ventricle is longer and more conical than the right, with its wall nearly twice as thick.

OPENINGS. — *The auriculo-ventricular* opening corresponds to the centre of the sternum; it is closed by the *mitral valve*, which is attached to the circumference similarly to the tricuspid. It consists of two flaps, the larger being anterior, which are furnished with chordæ tendineæ.

The aortic opening is placed in front and to the right side of the preceding, and its position may be marked externally by a line drawn through the sternum level with the lower border of the 2nd left costal cartilage. The orifice is guarded by three semilunar valves, which are precisely similar to those on the pulmonary artery; the characteristics are, however, better marked.

The columnæ carneæ are similar to those on the right side.

The endocardium is the serous membrane lining the whole of the interior of the heart, and is continuous with the lining membrane of the blood-vessels.

The arteries supplying the heart are the anterior and posterior coronary.

The nerves come from the cardiac plexuses.

ORGANS OF VOICE AND RESPIRATION.

THE LARYNX.

The Larynx is composed of cartilages connected together with ligaments and moved by muscles, the whole being lined with mucous membrane.

The cartilages of the larynx are:

The thyroid, consisting of two wings united in front, and forming the projection known as the *pomum Adami.* Each wing is quadrilateral in shape, the posterior border being rounded and prolonged into a *superior* and an *inferior cornu;* the latter articulates with the cricoid cartilage, but the former is free. On the external surface there is an oblique ridge. The inner surface of each ala is smooth, and at the point of junction with the other are attached :—the epiglottis, the true and false vocal cords, the thyro-arytenoid and thyro-epiglottidean muscles.

The cricoid cartilage is shallow in front, but deep behind; between this and the thyroid cartilage in front, is the crico-thyroid membrane. On the upper border of the posterior part, are two articular surfaces for the arytænoid cartilages; whilst on each side are two facets for articulation with the inferior cornu of the thyroid cartilage.

The arytænoid cartilages (2) are pyramidal in shape; the bases articulate with the cricoid cartilage, the true vocal cords being attached to their anterior angles. The apex looks inwards and backwards, and on it is the corniculum laryngis.

The cornicula laryngis, or cartilages of Santorini, are two small cartilages of conical shape attached to the apices of the arytænoid cartilages.

The cuneiform cartilages, or cartilages of Wrisberg, are two small cartilages often found in arytæno-epiglottidean folds.

The epiglottis covers the superior opening of the larynx; it is shaped like a leaf, the apex being attached to the angle of union of the ala of the thyroid cartilages; it is connected also to the hyoid bone by the hyo-epiglottic ligament.

The ligaments of the larynx are:

The thyro-hyoid membrane: passes from the upper border of the thyroid cartilage to the upper border of the inner surface of the hyoid bone. It is pierced by the superior laryngeal vessels and nerve.

(*The two lateral thyro-hyoid membranes*, part of the preceding, pass from the superior cornua of the thyroid to the tip of the great cornua of the hyoid bone.)

The crico-thyroid membrane: connects the thyroid and cricoid cartilages, passing laterally into the inferior margins of the true vocal cords.

Capsular ligaments: lined with synovial membrane, surround the articulations between the *cricoid* and inferior cornu of the thyroid, and also between the *cricoid* and two *arytænoid* cartilages.

The hyo-epiglottic ligament: connects the apex of the epiglottis to the hyoid bone.

The thyro-epiglottic ligament: connects the apex of the epiglottis to the back of the thyroid cartilage.

THE INTERIOR OF THE LARYNX.

The superior aperture of the larynx is triangular in shape, the base being directed forwards.

The cavity of the larynx extends from the *superior* aperture to the lower border of the cricoid cartilage. The vocal cords form an imperfect diaphragm, dividing the cavity into two parts. The chink between the true vocal cords is the *glottis* or *rima glottidis*, which is the narrowest part of the larynx.

The superior or *false vocal cords* are two folds of mucous membrane enclosing the superior thyro-arytænoid ligament.

The inferior or *true vocal cords* are attached in front to the receding angle of the thyroid cartilage, and behind to the anterior angle at the base of the arytænoid cartilage.

The ventricle of the larynx is the fossa between the false and true vocal cords; the anterior part of the ventricle is prolonged into a pouch, the *sacculus laryngis.*

The muscles of the larynx have been seen before, *v. p.* 27.

The arteries of the larynx are the laryngeal branches of the superior and inferior thyroid.

The nerves are the superior laryngeal, the inferior or recurrent laryngeal, and branches of the sympathetic.

THE TRACHEA.

The trachea extends from the lower border of the larynx (5th cerv. vert.) to opposite the 3rd dorsal vertebra, there dividing into two bronchi. In length it measures 4½ inches.

Relations in the Neck.

In front.	*Laterally.*
Isthmus of thyroid.	Common carotid artery.
Inferior thyroid veins.	Lateral lobes of thyroid.
Sterno-hyoid muscles.	Inferior thyroid artery.
Sterno-thyroid ,,	Infer. laryngeal nerve.
Cervical fascia.	
Anas. of ant. jugular veins.	

In the Thorax.

In front.
1st piece of sternum.
Thymus gland.
Arch of aorta.
Innominate arteries.
Left carotid ,,
Deep cardiac plexus.

Laterally.
Pneumogastric nerve.

Posteriorly.
Œsophagus.

The cartilages, from sixteen to twenty in number, are tunnel-shaped, the anterior ⅔ or convex part being cartilage, the posterior fibrous membrane.

The right bronchus, about one inch long, is shorter and more horizontal in direction than the left.

The left bronchus is nearly two inches long, and enters the lung about an inch lower than the former.

THE LUNGS.

The lungs, two in number, occupy the thorax, and are separated from each other by the heart and the mediastinum. The lungs are conical in shape and covered with pleura.

The *apex* projects under the clavicle into the root of the neck.

The *base* is concave and rests upon the diaphragm, and following the attachment of the midriff, is placed lower externally and posteriorly, than anteriorly. The *anterior margin* of the left lung presents a notch for the apex of the heart. The *outer surface* of each lung is convex and covered with pleura. The *inner* surface is concave and about its middle presents a slit (hilum pulmonis) where the root of the lung is attached.

The *right* lung is the larger and shorter of the two, and is divided by two fissures into three lobes.

The *left* lung is smaller and narrower than the right and is divided by a fissure into two lobes.

The root of each lung lies a little above the middle and nearer the posterior than the anterior border of the inner surface, and connects it with the trachea and heart.*

THE THYROID GLAND.

This is one of the ductless glands, and is situated at the upper part of the trachea, and consists of two lobes united by a neck or isthmus.

THE THYMUS GLAND.

This is also a ductless gland, which attains its full size at two years, after which it gradually shrinks away. It is situated partly in the anterior mediastinum and partly in the neck.

THE URINARY ORGANS.

THE KIDNEYS.

The kidneys secrete the urine and are situated in the posterior part of the lumbar region of the abdomen behind the peritoneum, extending from the 11th rib to nearly the crista ilii, the right being placed lower than the left. The average length of each kidney is four inches, breadth two inches, and thickness one inch.

Relations.—The relations of the two kidneys differ somewhat, though each is covered with peritoneum anteriorly.

Relations of the Right Kidney.

In front.	*Behind.*
Right lobe of liver.	Right crus of diaphragm.
2nd part of duodenum.	Quadratus lumborum.
Ascending colon.	Psoas.

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* For structures composing the root of the lung and its connections, see Brown's 'Aids to Anatomy.'

Relations of the Left Kidney.

In front.	*Behind.*
Cardiac end of stomach.	Left crus.
Lower border of spleen.	Quadratus lumborum.
Tail of pancreas.	Psoas.
Descending colon.	

Above each kidney is the supra-renal body.

Below each kidney is the iliac crest.

The external border is convex and is placed outwards and forwards.

The internal border is concave and at the centre is the fissure or *hilum*, where the vessels enter here, lying from before backwards as follows: renal artery, vein, ureter.

Each kidney is connected with the bladder by a ureter, which serves to convey urine to the latter viscus; the top of each ureter is expanded and forms the *pelvis of the kidney*, which is divided into three parts called *infundibula*, which are subdivided into *calices*. Into these calices small *papillæ* project, which are the apices of the *pyramids of Ferrein*, which latter form the medullary substance of the kidney.

The ureter connects the kidneys with the bladder.

Relations of the Ureter.

Behind.	*In front.*
Psoas.	Spermatic vessels.
Common or external iliac artery.	Ileum (right).
	Sigmoid flexure (left).

The *right* ureter lies close to the outer side of the inferior vena cava.

Supra-renal capsules: these are ductless glands, resembling in shape a cocked-hat, and which embrace the upper extremity of each kidney.

THE BLADDER.

The bladder receives the urine from the kidneys by the ureters.

Position.—In *infancy* it lies in the abdomen. In the *adult* it lies in the pelvis behind the pubes; *in the male* in front of the rectum; *in the female* it is placed before the uterus and vagina.

Difference in the sexes: the female bladder is larger transversely and has a greater capacity than that of the male.

The *apex* is connected to the umbilicus by the urachus and by the obliterated hypogastric arteries; the part posterior to the urachus is covered with peritoneum.

The *body* is uncovered anteriorly by peritoneum, and in front are the triangular ligament of the urethra, the symphysis pubis, and the internal obturator muscles. Posteriorly it is covered by peritoneum, and is in relation with the *rectum* in the male and uterus in the female. Crossing obliquely on each side of the bladder is the obliterated hypogastric artery, which forms the limit laterally of the peritoneum; the vas deferens crosses obliquely the lower part of the lateral surface along the inner side of the ureter.

The *base* or *fundus* is directed forwards and downwards.

Relations of the Base.

In the male.		*In the female.*
Below.	*Behind.*	*Below.*
Rectum 2nd pt.	Peritoneum.	Cervix uteri.

The *cervix* or neck of the bladder is the part continuous with the urethra.

LIGAMENTS.—There are two sets of ligaments of the bladder, true and false; the former are five in number, and are formed of the recto-vesical fascia and the urachus.

There are two anterior and two posterior true ligaments and the urachus.

The false ligaments, five in number, are formed of peritoneum; there are two posterior, two anterior and a superior, the latter covering the urachus.

Interior of the bladder.—Upon the inner surface of the base of the bladder, just behind the urethral orifice, is a triangular smooth surface or trigone, with the apex looking forwards. It is bounded laterally by two ridges passing to the openings of the ureters, the posterior angles being formed by those openings; at its apex there is an elevation formed by the prostate called the *uvula vesicæ*.

THE MALE ORGANS OF GENERATION.

THE PROSTATE GLAND.

The prostate gland surrounds the neck of the bladder and the beginning of the urethra. It is said to resemble a horse-chesnut in shape, with the apex directed forwards. It measures about 1½ inches across its base and half that in depth, and is held in position by the anterior true ligaments of the bladder.

The gland consists of three lobes, two lateral and one middle, and is perforated from base to apex by the urethra. The common seminal ducts open into the prostatic portion of the urethra, and are placed between the middle and lateral lobes.

COWPER'S GLANDS.

These are two small round bodies about the size of a pea placed under the membranous part of the urethra between the two layers of the deep perineal fascia. Their ducts are about one inch long and pass forwards to open in the bulbous part of the urethra.

THE PENIS.

The penis is divided into a root, body, and glans.

The *root* is connected to the pubic rami by two strong processes, the crura, and to the symphysis pubis by the suspensory ligament.

The *glans* forms the extremity; at its summit is the opening of the urethra, the *meatus urinarius;* passing from the bottom of this is a fold of mucous membrane continuous with the prepuce and called the *frenum præputii.* At the base of the glans is a projecting edge or *corona,* and behind that a constriction, the *cervix.* Sebaceous glands (of Tyson) are found on both. The integument of the penis is doubled upon itself, and attached to the neck of the glans, forming the *prepuce* or *foreskin.*

The *body* is the part between the root and the glans; the upper surface being the *dorsum.*

The corpora cavernosa forms the greater part of the body of the penis; they are two cylindrical tubes placed side by side, connected together for the anterior ¾th, the *septum pectiniforme* being between, but are separated behind to form the two crura, which are attached to the projecting edges of the pubic rami; anteriorly the corpora cavernosa fit into the base of the glans. There is a groove on the upper surface for the dorsal vein of the penis and another groove on the lower surface for the corpus spongiosum; the corpora are attached to the pubic symphysis by a suspensory ligament.

The corpus spongiosum commences at the triangular ligament by an enlargement, the *bulb,* and runs forward in the groove on the under surface of the corpora cavernosa, expanding over their extremities to form the glans. The *bulb* is covered by the anterior layer of the triangular ligament, and is embraced by the accelerator urinæ, and is pierced by the urethra near its upper surface.

THE URETHRA.

The *urethra* in the male extends from the neck of the bladder to the end of the penis, and has a length of from eight to nine inches. It is divided into three parts, according to the structures through which it passes.

(1) The *prostatic* portion passes through the prostate gland from base to apex; this part is 1¼ inches long and spindle-shaped. On the floor is a longitudinal ridge, the *verumontanum* or *caput gallinaginis,* and on each side of

this promontory is a depression, the *prostatic sinus*, into which the prostatic ducts open. Towards the anterior part of the verumontanum is a depression, the *sinus pocularis*, upon the elevated edges of which the ejaculatory ducts open.

(2) The *membranous* portion extends from the apex of the prostate to the bulb, and is ¾ inch long above but only ½ inch below from the bulb projecting below it; it is contained principally between the layers of the triangular ligament and is surrounded by the compressor urethræ.

(3) The *spongy* portion is contained in the corpus spongiosum and occupies the rest of the canal, being six inches long; the portion contained in the bulb is somewhat dilated, and the ducts of Cowper's glans open on the floor; the canal enlarges again just below the meatus urinarius, which is named the *fossa navicularis*. The floor is sprinkled with *lacunæ*, being openings of the *glands of Littré;* one large one in the fossa navicularis is called the *lacuna magna*.

THE SCROTUM.

The scrotum contains the testicles and spermatic cords. It is divided in the middle line by a *raphé;* the left half is longer than the right, as the left testicle hangs down lower, the left spermatic cord being longer than its fellow.

THE SPERMATIC CORD.

The spermatic cord consists of the vas deferens with it vessels and nerves, spermatic vessels and nerves, the cremasteric artery, the genital branch of the genito-crural nerve lymphatics, together with some areolar tissue; it extend from the internal abdominal ring to the back of the testis The *vas deferens* is placed at the back of the cord, and may be recognised by its hard and cord-like feeling.

THE TESTES.

These two glandular organs are suspended in the scrotum by the spermatic cords, which are attached to the posterior borders. Each testis consists of two parts : the *body*, which is anterior, and the *epididymis*, which is posterior ; from the lower end of this latter the duct or vas deferens is attached.

Coverings of the Testis.

1. *Serous* or *tunica vaginalis* is derived from the peritoneum and consists of two parts, the visceral and parietal.
2. *Fibrous* or *tunica albuginea* covers the body of the testicle, sending in a vertical septum the *mediastinum* or *corpus Highmorianum ;* this latter gives off secondary processes or *septa*, which serve to separate the lobules of the testicle.
3. *Tunica vasculosa* consists of the blood-vessels, connected together with areolar tissue.

The epididymis is a long narrow body, consisting of three parts, viz. : *body* or central portion, *head* or *globus major*, and tail or *globus minor*, with which the *vas deferens* is continuous.

The vas deferens commences at the lower part of the globus minor and ascends along the inner side of the posterior part of the epididymis ; thence it follows the spermatic cord through the canal and internal abdominal ring. In the pelvis it crosses to the inner side of the external iliac artery, and arches over the back of the bladder, crossing the obliterated hypogastric artery. At the base of the bladder it runs along the inner side of the vesiculæ seminales, here becoming sacculated ; narrowing again at the base of the prostate, it unites with the duct of the vesicula seminalis, and forms the *common ejaculatory duct.*

THE VESICULÆ SEMINALES.

The vesiculæ seminales are two sacculated pouches, placed at the base of the bladder. They are pyramidal in shape, the posterior part being the wider ; anteriorly they converge to enter the prostate near the middle line. The vasa deferentia lie close to their inner sides.

FEMALE ORGANS OF GENERATION.

The external organs of generation in the female are : the mons veneris, the labia majora, the labia minora, the clitoris, the meatus urinarius, and the orifice of the vagina. The term *vulva* includes the whole of these.

The mons veneris is the eminence in front of the pubes, covered with hair.

The labia majora are two prominent folds extending from the mons to the perineum. External they are covered with hair and integument, internally with mucous membrane ; the labia are joined together anteriorly and posteriorly, forming commissures. A small transverse fold is found in the posterior commissure called the fourchette ; the space between this and the commissure is known as the *fossa navicularis.*

The labia minora or *nymphæ* are two folds of mucous membrane, extending for 1½ inches downwards and outwards from the clitoris, finally losing themselves below in the labia majora. They surround the clitoris, the upper folds forming the *preputium clitoridis*, the inferior ones, attached to the glans, being the *frænum.*

The clitoris, corresponding somewhat in structure to the penis, is placed just before the anterior commissure. It consists of two corpora cavernosa attached to the two pubic rami by two crura ; the free extremity or glans is very sensitive. Between the nymphæ, and bounded anteriorly by the clitoris, is the *vestibule,* at the back part of which the *meatus urinarius* opens, being about one inch below the clitoris.

Below the meatus is the orifice of the vagina, closed more or less in the virgin by the *hymen*, which is a duplicature of mucous membrane, generally semilunar in shape. After its rupture small elevations, *carunculæ myrtiformes*, only remain.

The glands of Bartholin, analogous to Cowper's glands, are situated on each side near the entrance of the vagina, and their ducts open on the nymphæ, external to the hymen.

The urethra in the female is only 1½ inches long and is embedded in the anterior wall of the vagina; it perforates the triangular ligament, as in the male.

The vagina is a dilatable canal extending from the vulva to the uterus; the anterior wall is about four inches and the posterior wall from five to six inches long. The upper end widens to receive the neck of the uterus.

The relations are:

Anteriorly.	*Posteriorly.*	*Laterally.*
Base of bladder.	Rectum.	Broad ligament.
Urethra.	Pouch of Douglas.	Levator ani.

There is a ridge or *raphé* along the middle of the inner surface of both the anterior and posterior walls. They likewise present many transverse ridges or *rugæ.* The lower end of the vagina is embraced by the sphincter vaginæ.

THE UTERUS.

The **uterus** or womb is a pear-shaped body, flattened from before backwards, placed in the pelvis between the bladder and rectum; superiorly it does not reach above the brim of the pelvis. The position corresponds to the pelvic axis. The uterus is covered by peritoneum behind, above, and in front except where it is attached to the base of the bladder; the peritoneum is reflected from off the sides forming the *broad ligaments.* The average length is three inches, and is, for the purpose of description, divided into three parts:

(1) The *fundus* is the broad upper end of the body, projecting into the abdomen between the attachments of the Fallopian tubes.

(2) The *body* extends from the fundus to the neck, narrowing as it approaches the latter; at the junction of the fundus

and body is an angle to which the Fallopian tube is attached; and a little anteriorly the *round ligament* is connected, and below and behind the ovarian ligaments.

(3) The *neck* or cervix uteri is surrounded below by the vagina, into which it projects, forming a vaginal part, which presents a transverse opening, the *os uteri*, the *os uteri externam*, or the *os tineæ.*

The *cavity* of the uterus is triangular in shape, the superior angles leading to the Fallopian tubes. Where the body joins the neck there is a constriction, the *os uteri internum.*

The **ligaments** are two anterior or vesico-uterine, two posterior or recto-uterine, and two lateral or broad ligaments.

THE APPENDAGES OF THE UTERUS.

The Fallopian tubes are two in number, placed in the upper margin of the broad ligament. Each tube measures about four inches in length. The cavity commences by a narrow orifice called the *ostium internum*, and terminates in a fimbriated extremity, which embraces the ovary at certain times.

The ovaries are two in number, and correspond to the testes in the male; they are of a flattened ovoid form, placed in the posterior part of the broad ligament. Anteriorly the ovary is connected to the broad ligament; and internally to the uterus by a proper ligament, extending to the superior angle of the uterus, and called the ligament of the ovary.

The round ligaments are two cords placed between the layers of the broad ligament, extending from the superior angles of the uterus to the internal abdominal ring; thence it passes into the inguinal canal to lose itself in the labia; it is enclosed for some part of the way in peritoneum, which is known as the *canal of Nuck.*

THE ORGANS OF SENSE.

THE TONGUE.

The tongue occupies the floor of the mouth; posteriorly it is connected with the hyoid bone, the epiglottis, the soft palate, and the pharynx; inferiorly it is attached to the lower jaw by the genio-glossi muscles.

The mucous membrane: on the under surface is smooth, forming a median fold, the *frænum linguæ;* on the sides it is continuous with the mucous membrane of the mouth. On the dorsum there is a *raphé* along the middle line, which ends posteriorly in the *foramen cæcum.* Posteriorly the epiglottis is connected to the tongue by three glosso-epiglottic folds. The anterior two thirds of the dorsum of the tongue is covered with papillæ; they are of three kinds:

The *circumvallate* papillæ (seven to ten) form a row on each side at the back of the tongue, meeting in the middle line Λ.

The *fungiform papillæ:* found principally at the apex and on the sides.

The *filiform papillæ* are numerous, and are arranged in rows parallel to the circumvallate, but towards the tip of the tongue their direction becomes more transverse.

Taste buds: supposed to be the organs of taste, are flask-shaped bodies found buried in the epithelium around the circumvallate papillæ.

THE NOSE.

The organ of smell consists of an anterior prominent part and two nasal fossæ.

The nose is the anterior part projecting from the face; it is constructed of bones and cartilages, covered with muscles and skin externally, and with mucous membrane internally. Inferiorly are the two nostrils. separated by the *columna*, around which orifices are arranged stiff hairs, *vibrissæ*.

The cartilages of the nose are five in number :

The *upper lateral cartilages* (2) : situated just below the free margins of the nasal bones. Each cartilage is triangular in shape, flattened, thicker anteriorly than where it joins its fellow and the cartilage of the septum ; posteriorly it is in connection with the nasal process of the superior maxilla, and inferiorly it joins the lower lateral cartilage.

The *lower lateral cartilages* (2) : are peculiarly curved to form the nostrils ; posteriorly each cartilage is connected to the nasal process of the superior maxilla by fibrous membrane, in which are two or three sesamoid cartilages ; above it joins the upper cartilage and the cartilage of the septum.

The *cartilage of the septum* is thicker at the edges than at the centre ; its connections are : anteriorly with the nasal bones, the two upper lateral cartilages and the lower lateral cartilages ; posteriorly with the perpendicular plate of the ethmoid ; inferiorly with the vomer and the palatal processes of the superior maxillæ.

The nasal fossæ : open in front by the anterior nares and behind by the posterior nares. Each fossæ may be described as possessing a roof, a floor, an inner and an outer wall.

The *roof* is formed by the nasal bones, the nasal spine of the frontal, the cribriform plate of the ethmoid, the under surface of the body of the sphenoid, sphenoidal turbinate bones.

The *floor* consists of the palatal processes of the superior maxilla and of the palate bones.

The *inner wall* is constructed by the crest of the nasal bones, the nasal spines of the frontal, the perpendicular plate of the ethmoid, the vomer, the rostrum of the sphenoid, and the crests of the superior maxilla and palate bones.

The *outer wall :* nasal process of the superior maxilla, the lachrymal bones, the ethmoid, inner surface of the superior maxillæ, the inferior turbinate bones, the vertical plate of the palate bone, and the internal pterygoid plate of the sphenoid.

The nasal fossæ are lined by a mucous membrane called the *pituitary* or *Schneiderian*, which is continuous with that of the pharynx, with the conjunctiva, with the lining of the tympanum and mastoid cells, the frontal ethmoidal and sphenoidal sinuses, and the antrum.

THE EYE.

The eyeball is contained in the orbit; its shape is spherical, with the segment of a smaller sphere placed anteriorly.

The eyeball consists of the following coats:

$$\text{First coat.} \begin{cases} \text{Sclerotic.} \\ \text{Cornea.} \end{cases}$$

The sclerotic is thicker posteriorly than anteriorly, it is white externally, and receives the insertion of the muscles which act on the globe; internally it is of a dark brown colour, with grooves for the ciliary nerves, and connected with the external surface of the choroid by the *lamina fusca*. The optic nerve passes through this membrane behind and to the inner side; this spot is the *lamina cribrosa*, as it is traversed by fibrous septa, an opening in the centre of the lamina, the *porus opticus*, transmits, the central artery of the retina; anteriorly the sclerotic is continuous with the cornea, overlapping it.

The cornea is the anterior transparent part of the outer coat of the eyeball; it is convex anteriorly, and has been likened to a watch-glass projecting from its case; the anterior surface is consequently smaller than the posterior. The cornea is constructed of five layers, which are arranged from within out as follows:

(1) The conjunctiva, (2) anterior elastic lamina, (3) cornea

proper, (4) posterior elastic lamina, (5) posterior epithelial layer. Branches of the ciliary nerves may be found in the laminæ.

Second coat.
- Choroid.
- Iris.
- Ciliary processes.
- Ciliary muscle and ligament.

The choroid or vascular coat extends as far forwards as the cornea, terminating at the ciliary ligament by the ciliary processes. Behind, the optic nerve pierces it; the inner surface is dark and covered with the pigment cells of the retina.

The ciliary processes (70) are formed by a folding inwards of the choroid; they are arranged round the edge of the lens behind the iris.

The iris is the coloured membrane suspended in the aqueous humour in front of the lens; in the centre is an aperture, the *pupil*. By the circumference it is connected to the choroid, and anterior to this to the ciliary ligament, by which it is connected to the cornea and sclerotic.

The ciliary muscle surrounds the circumference of the iris; it arises from the junction of the sclerotic and cornea, and is inserted into the choroid opposite the ciliary processes. The origin of this muscle used to be described as the ciliary ligament.

The retina contains the terminations of the optic nerve; it lies within the choroid coat, and the vitreous humour lies inside; it extends forwards as far as the ciliary muscle, where it ends with a saw-edged border, the *ora serrata*. The outer surface is covered with pigment cells. On the inner surface in the axis of the eye is a yellow spot, *macula lutea*, and in the middle of this a depression, *fovea centralis*. About one tenth of an inch to the inner side is the *porus opticus*, transmitting the central artery of the retina.

The aqueous humour occupies the anterior and posterior chambers of the eye.

The anterior chamber is bounded anteriorly by the cornea and posteriorly by the iris.

The posterior chamber is bounded anteriorly by the iris, and posteriorly by the capsule of the lens, the suspensory ligament, and the ciliary processes.

The vitreous body occupies the concavity of the retina, and is enclosed in a *hyaloid* membrane. In front it is closely adherent to the lens and its capsule.

The capsule of the lens is a thin transparent membrane surrounding the lens, forming by its anterior surface the back of the posterior chamber. It is maintained in its position by the suspensory ligament of the lens.

The lens is a transparent body, convex anteriorly and posteriorly, more so on the latter; it is enclosed in the capsule. The *canal of Petit* surrounds its circumference,

The suspensory ligament is placed between the anterior surface of the vitreous body and the ciliary processes.

APPENDAGES OF THE EYE.

The eyebrows are two arched eminences over each orbit, consisting of thickened integuments and muscles, surmounted by hairs.

The eye-lids are two movable folds, an upper and a lower, the upper one being more movable, which by their closure protect the eye from injury. When the eye-lids are open the angles of junction of the upper and lower lids are called *external* and *internal canthi.* In the inner canthus the lids are separated by the *lacus lachrymalis*, which is occupied by the *caruncula lachrymalis*, and opposite the commencement of this, on each lid is the *lachrymal papilla*, which is pierced by the *punctum lachrymale.*

Structure from without inwards: skin, areolar tissue, orbicularis muscle, tarsal cartilage, fibrous membrane, Meibomian glands, conjunctiva; the upper lid has also the aponeurosis of the levator palpabræ.

The lachrymal gland occupies a depression in the external angle of the orbit; the anterior margin is connected to the back part of the upper eye-lid, ;

The lachrymal canals commence at the *puncta lachrymalia*, which are the openings of the canaliculi, which join to enter the *lachrymal sac.*

The lachrymal sac is placed in a groove formed by the lachrymal bone and the nasal process of the superior maxilla; it is the dilated upper end of the nasal duct.

The nasal duct leads from the lachrymal sac to the inferior meatus of the nose, where it opens by a valve formed of the mucous membrane.

THE EAR.

The ear is divided, for the purpose of description, into three parts, external, middle, and internal.

THE EXTERNAL EAR.

The external ear consists of the auricle or *pinna* and the *external auditory meatus.*

The pinna is a plate of cartilage covered with integument and attached to the commencement of the meatus; it has numerous ridges and depressions, as follows: the external rim is the *helix*, and anterior and parallel to it is another ridge, the *anti-helix*, which is bifurcated above to enclose the *fossa of the anti-helix;* between the helix and anti-helix is the *fossa of the helix.* Anterior to the anti-helix is a depression, the *concha;* projecting backwards over the meatus is the *tragus*, and opposite to the latter is the *anti-tragus;* the lowest part of the pinna is called the *lobule.*

The external auditory meatus reaches from the bottom of the concha to the membrana tympani. It is arched slightly upwards, and is directed forwards and inwards; it is formed in part by cartilage and in part by bone. The outer or cartilaginous part is continuous with the pinna, and is about half an inch long; the inner or osseous part is longer than the preceding, and at its inner end there is a groove round the sides and floor for the insertion of the membrana tympani. In the outer part of the meatus are hairs and ceruminous glands, which latter secrete the ear-wax.

THE MIDDLE EAR OR TYMPANUM.

The tympanum is contained in the temporal bone. It communicates with the pharynx by the Eustachian tube, and is traversed by a chain of bones, which connect the membrana tympani with the internal ear.

The cavity of the tympanum is bounded *externally* by the meatus and membrana tympani, *internally* by the external surface of the internal ear, and it communicates posteriorly with the mastoid cells.

The roof is formed by a thin plate of bone separating the tympanum and the cranium.

The floor is formed by the roof of the jugular fossa.

The outer wall is formed by the membrana tympani and the bone around it; the following fissures are seen:

The Glasserian fissure: through which the processus gracilis of the malleus, the laxator tympani, pass.

Aperture of the iter chorda posterius: leading to a canal, which opens into the aquæductus Fallopii.

Aperture of the iter chorda anterius: leading to the canal of Huguier, and transmitting the chorda tympani.

The inner wall presents the following:

The fenestra ovalis: leading into the vestibule.

The ridge of the aquæductus Fallopii: placed just above the preceding.

The promontory: placed below the fenestra ovalis, formed by the projecting cochlea.

The fenestra rotunda lies at the bottom of a funnel-shaped depression, and leads to the cochlea.

The pyramid is placed just behind the fenestra ovalis; i contains the stapedius, the tendon of which projects through the apex.

The posterior wall presents many irregular apertures which are the *openings of the mastoid cells.*

The anterior wall shows the following:

The canal for the tensor tympani, the Eustachian tube, an *the processus cochleariformis;* the latter is a process of bon separating the two canals; the canal for the tensor is th smaller of the two, and is rounded; it transmits the tendon of the tensor tympani.

The Eustachian tube leads into the pharynx, is partly cartilaginous and partly osseous; the internal or cartilaginous part is trumpet-shaped and terminates in an oval opening.

The membrana tympani is the membrane which divides the external and middle ears; it contains between its layers the handle of the malleus, which makes the membrane concave externally.

The ossicles of the tympanum are:

The malleus or hammer, attached by a thin process, the handle, to the membrana tympani; has a head separated from the handle by the neck, on which latter are two processes, one short for the tensor tympani, the other, processus gracilis, extends down the Glasserian fissure for the laxator tympani.

The incus or anvil is like a bicuspid tooth, with the part answering to the crown articulating with the malleus; has two processes, the short one is attached to the margin of the mastoid opening, and the long one, terminating in the os orbiculare, articulates with the stapes.

The stapes closely resembles a stirrup; the head articulates with the incus, the neck receives the stapedius, and the base is fixed to the margins of the fenestra ovalis.

THE INTERNAL EAR.

Within the internal ear is the auditory nerve. It is called the labyrinth, and is divided into *osseous* and *membranous*, the former enclosed within the latter. Within the membranous labyrinth is a fluid, the *endolymph*, and outside, between the membranous and osseous labyrinths, is a fluid, the *perilymph.*

THE OSSEOUS LABYRINTH consists of the vestibule, the cochlea, and the semicircular canals.

The vestibule is the central part of the labyrinth. On its outer wall is the *fenestra ovalis*, closed by the base of the stapes; on its *inner wall* is a depression, the *forea hemi-spherica*, perforated by several holes for the divisions of the auditory nerve, and behind this is a ridge, the *crista vestibuli*. Behind the crest is the *aqueduct of the vestibule*. On the roof is a depression, the *fovea hemi-elliptica*. At the posterior part are the five openings of the *semicircular canals*, and at the anterior part the *apertura scalæ vestibuli*.

The semicircular canals are three arched osseous canals opening into the vestibule, forming about two thirds of a circle; each present at one end a dilated part, *the ampulla*. Two of the canals are vertical and the third is horizontal.

The cochlea is cone-shaped and consists of a tapering spiral canal, with the inner wall formed by its axis or *modiolus;* the canal is divided into two scalæ by a partition of bone and membrane, the *lamina spiralis*. The enclosed arched extremity of the cochlea is called the *cupola*, and the first turn of the canal bulging into the tympanum forms the promontory. The *lamina spiralis ossea* end at the apex of the cochlea in a small *hamulus*, which when detached leaves a small opening, the *helicotrema*, by which the two scalæ communicate.

The scalæ are known respectively as the scala tympani and the scala vestibuli.

The scala tympani is the lower one; it commences at the fenestra rotunda.

The scala vestibuli commences at the cavity of the vestibule.

Besides these two scala there is a third space, the scala media, being separated from the scala vestibuli by the *membrane of Reissner* and the floor formed by the basilar membrane, which is the part of the lamina spiralis; this swells out at its extremity, forming the *ligamentum spirale*.

The limbus laminæ spiralis is the swollen periosteum at the edge of the lamina spiralis, which terminates in a grooved edge, the *sulcus spiralis*, the lower lip of which attaches the basilar membrane.

The rods of Corti are contained in the space between the upper and lower lips of the sulcus spiralis.

THE MEMBRANOUS LABYRINTH is a closed sac containing the endolymph, and on the wall of which are the endings of the auditory nerve. In shape it resembles the osseous labyrinth.

The vestibular portion consists of the *utricle* and the *saccule*, which are distinct from one another.

The membranous semicircular canals are about one third the size of the osseous ones ; they open by five openings into the utricle.

The scala media forms the membranous part of the cochlear, and has been already described.

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THE END.

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